THE
# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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**THE**
**UNIVERSAL ELECTRICAL DIRECTORY**
**(J. A. BERLY'S).**

**1908 EDITION**

**H. ALABASTER, GATEHOUSE & CO.,**
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## L.C.C. TRAMWAY FINANCE.

THE report prepared by Messrs. W. B. Peat and F. W. Pixley, two eminent professional accountants, upon the L.C.C. Tramway undertaking may be pronounced a striking and interesting document, though in principle it contains little more than is commonly accepted by accountants generally. For our part, however, and we say it without any intention of personal disparagement, we should have preferred the investigation to have been conducted by two accountants specially skilled in tramway accounting, auditing and finance. With much of the report we find ourselves in accord, and particularly in regard to such matters as the insufficiency of the renewals reserve fund and the apportionment of expenditure as between street improvement and tramway accounts to which we have frequently drawn attention.

The report is divided into three sections—viz., Horse Traction, Electric Traction, and Renewal Funds. Under the first-named heading the total net expenditure up to March 31st, 1907, was £2,380,737, which is being repaid as to £1,819,831 over a period of 60 years, as to £463,117 over a period of 25 years, and as to £97,787 over a period of eight years, the debt outstanding at March 31st, 1907, being £2,010,902. The capital account at March 31st, 1907, is made up of £2,380,736 in respect of horse traction, and £4,356,000 due to electric traction, making a total of £6,736,737.

"This principle, in our opinion, is not sound, because there are practically no existing assets to represent the horse system of traction so far as it has been displaced. It is suggested that a certain residue of value exists in some of the displaced horse-traction assets; but in our opinion this value cannot alter the fact that there is a large loss not provided for on the displacement of the horse-traction system, the loss being made up as follows:—

| | | | |
|---|---|---|---|
| Permanent way and general (including good-will) (*a*) track cost... ... ... ... | £1,017,942 | 9 | 11 |
| Add payments to the tramway companies in respect of their expenditure on street improvements (included in purchase prices) ... ... ... ... ... | 23,826 | 3 | 0 |
| Additions by Council ... ... ... | 13,827 | 6 | 11 |
| | £1,055,595 | 19 | 10 |
| Less proceeds of sales of old material ... | 27,944 | 8 | 8 |
| Leaving a balance of ... ... ... | £1,027,651 | 11 | 2 |

Which represents the track of the horse tramways which has been displaced, or is in process of being displaced, by the electric system.

While we recognise that the Council had no means of writing off at once the loss on the displaced assets of the horse system, we consider that such loss should be provided for out of revenue *more rapidly* than by the charging of the annual instalments in repayment of the debt. Until these losses are provided for there can be no profits applicable for the relief of the rates."

All this is more or less beside the point. The whole question is that certain horse tramway undertakings have been acquired by the Council with a view to their reconstruction or conversion to

electric traction. The cost of them has been properly charged, of course, to capital, and that the cost has been defrayed out of borrowed money, which is repayable during certain terms, an amount corresponding with each capital repayment—sinking fund—being charged against revenue, thus in course of time extinguishing the asset. The Council, however, has substituted in the meantime for the horse tramways, electric traction, and because there has been a loss—a natural and unavoidable loss—in consequence of the Council having laid down a better system of greater earning capacity for that which was obsolete, they are to apply the whole of their surplus to the credit of the asset displaced until the debit has become extinct. This is sound, we agree, but somewhat Utopian. The Council is liquidating the debt, including the loss, but not fast enough for Messrs. Peat and Pixley.

Mr. M'Kinnon Wood and Sir J. Williams Benn, in a letter issued to the Press on the day of publication of the report, refer to the undertakings of the Metropolitan Electric Tramways, Ltd., and the London United Tramways Co., and with our usual impartiality we may briefly refer to the company side of the matter. The Metropolitan Tramways, Ltd., acquired certain horse tramways from the North Metropolitan Tramways Co., which is coming to an end, having been swallowed by the Metropolitan Electric Tramways, Ltd., which is a branch of, and under the effective control of, the British Electric Traction Co. Although the horse tramways were displaced long ago, the expenditure, a large loss, remains amongst the electric traction assets of the company, less, of course, the realisation of sales of old material therefrom, and so forth, and we imagine that there it is likely to remain. Other examples include the London United Tramways Co. and the District Railway, which may be profitably investigated.

In some cases companies (we do not refer to Parliamentary companies) have charged during construction a proportion of their debenture interest to capital account—a heinous offence in some quarters. It may not be sound, but it is perfectly justifiable under proper conditions. In others, we may observe the allocation to capital of a certain proportion of what is revenue expenditure in the ordinary course of things.

We could multiply instances; but we shall only refer briefly to one more. When the Metropolitan Tramways, Ltd., acquired its horse tramways from the North Metropolitan Co., it also effected an exchange of shares with shareholders of that company at a cost of over £700,000—the object, of course, was obvious—and in the process of absorbing the Harrow Road and Paddington undertaking, it also acquired certain shares and debentures of that company. All the outlay represented thereby is included as an asset in the capital expenditure of the Metropolitan Electric Tramways, Ltd., and the "capital expenditure incidental to and upon the purchase of tramway undertakings, acquisition of rights conversion to electric traction," and so on, less a sum of £276,000 received upon realisation. There must, therefore, in the case of the shares and debentures acquired in these concerns by the Metropolitan Electric Tramways, Ltd., be a further loss—included in the capital expenditure named, and likely, we should say, to remain there—of some half a million, which is not represented by any asset at all, and yet no steps have been taken to write it off. Write it off, forsooth! What would become of the poor shareholders, and "what would the British Electric Traction Co. do then, poor thing"?

Last year's accounts show that it has also received £54,000 being the proportion due to the Metropolitan Electric Tramways, Ltd., on its shareholding in the North Metropolitan Tramways Co., in respect of the compensation received by the latter company from the L.C.C. in consequence of its surrender of the lease of certain other tramways from the Council before the due date. One would have expected, in the face of the large loss mentioned, and unrepresented by assets, that this compensation would have been capitalised against the deficit on the shares, &c. Instead of that, however, one half of it was taken to the credit of the revenue account in 1906—otherwise the company would have experienced some difficulty in paying its ordinary dividend—and the other half was put to suspense. In the accounts for 1907 which we have received, we notice that it has been decided to apportion the remaining half, £27,000, to the credit of profit and loss over each year until 1910, so that it takes to the credit of revenue for 1907 a sum of £7,850.

Messrs. Peat and Pixley state that, between the years 1897-1904 some £293,592 of the earnings of the horse traction has been applied in relief of rates, and "we consider that this amount should have been reserved towards the loss referred to," and that "until the revenue of the tramways has been charged with (1) the losses in displaced assets of the horse system; (2) a full provision for renewals on the system now in force; (3) the charges in respect of the outstanding debt; and (4) a proportionate amount of the full central office charges, we are of opinion that no sum will (? should) be available for relief of rates," and so on.

The renewals and reserve fund is not regarded as satisfactory, and here we are in full agreement with the report. In very few tramway undertakings, however, either municipal or otherwise, is a sufficient provision made for depreciation, and this we have over and over again emphasised. The accountants state that it is impossible for them to fix a rate. Of course it is; electrical men are capable of doing that for themselves in the light of past practical experience. The Council, says the report, has been advised by its officers that at least 1d. per car-mile should be provided for the renewals and reserve fund. Rates per car-mile are more or less rule of thumb. The Metropolitan Electric Tramways, Ltd., provides about ½d. per car-mile from a rough calculation of the sums which it has reserved during the past three years, which is better than some undertakings provide for, and is better than nothing. If this method be adopted—if it can be called method—we consider that the rate should not be less than 1d. per car-mile, and if in the Council's undertaking this rate had been observed, there would have been an accumulated provision of £182,636 at the end of March 31st, 1907, whereas the actual amount set aside was £105,000.

With regard to the extent to which the tramways should bear the cost of street improvements we are quite in agreement with the auditors. They are of opinion that the proportion of the cost of the street improvements and widenings which should be charged to the tramways should bear a direct relation to the benefit derived, or to be derived, by the tramways.

(*a*) When the improvements were undertaken wholly to accommodate the tramways and were not otherwise necessary.

(*b*) When improvements were undertaken along a route concurrently with the construction of a tramway.

(*c*) When the improvements were undertaken with the object of accommodating general traffic, and also providing a sufficient width of thoroughfare for a contemplated construction of tramways.

(*d*) When the tramways although constructed derive in common with the general traffic benefit from the improvement.

The subsequent explanation of (*d*) is somewhat debateable. There are many other points in the report, and these it may be necessary to refer to from time to time as the controversy which the report begins is contributed to by those concerned with the practical financial operations of our various tramway systems.

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**Cables and the Colonies.**

The firm purpose with which representative men in Canada are urging the cause of the development of the Imperial cable system must in the end succeed in bringing about improvements in the existing service, but it is doubtful whether the best results are likely to be secured exactly in the way that they now advocate. As a broad principle, State ownership is almost invariably less productive of effective and efficient working than is private enterprise,

but we are prepared to admit that under certain conditions State ownership is the only way of driving a wedge between obstinate monopolies. For example, in this country, owing to the corruption and arbitrary dealings of the old telegraph companies, State purchase became almost obligatory for inland telegraphs. With the strengthening of the law relating to such undertakings, those conditions have in some measure passed away, while the objections to State ownership have in many respects increased. Under existing circumstances, therefore, the balance between public and private management of this proposed girdle for the Empire would have to be carefully considered, and this would be the primary step in establishing a co-ordinated system. One thing, however, is certain; private enterprise, without imperial good-fellowship with the private cable companies, would inevitably fail.

The Board of Trade of the City of Ottawa, constituted for 50 years, have selected as a means of celebrating their jubilee, an organised attempt to bring the question of Colonial cables forcibly before the Empire. They recently sent delegates to the Governor-General of Canada, who were received in a very sympathetic manner by Earl Grey. Moreover they have issued a direct appeal "to the citizens of the Empire," and we can assure them that with their main purpose we are in cordial agreement; we join with them, as we have always done, in the desire "to advance the movement to cheapen telegraphy, by land and sea, throughout the Empire." To this appeal Sir Sandford Fleming contributes a preface, and although it is difficult to follow the argument in favour of an Imperial intelligence union in combination with a State-aided cable system, the idea of completing the network between the scattered units that make up Greater Britain stands out clearly from his remarks. Behind the whole matter is, of course, the question of finance, and he cites the case of the Pacific cable as being more or less successful, going so far as to declare that if the returns are examined, "it will be found that there never has been any loss in working the cable." The matter that more concerns us is, whether it would have shown more profit if it had been run as a private venture. He makes a good point regarding the fact that Canada "is the only country within the wide range of the British Empire where the telegraph service is not, like the postal system, a service of the State," and he emphasises the drawbacks that have arisen from the circumstance that the Pacific cable messages have to pass by way of the wires of the Canadian Pacific Railway Co. It is certainly disquieting to hear that transmission across the Dominion was interrupted, in 1903, 33 times, or a total of 166 hours; in 1904, 27 times, or 97 hours; in 1905, 22 times, or 42 hours; and in 1906, 50 times, or 183 hours. He observes that the question is asked: "Why is the Canadian telegraph system not naturalised, and all cause of complaint removed?" But he does not demonstrate that the nationalising process would in fact remove all cause of complaint against the telegraph system. It certainly does not do so in this country, where landlines are still in use.

The main contention, however, seems incontrovertible, and there seems to be great scope for a bold scheme to complete the linkage. What is it but the cable system that gives assurance to the Empire, and that conveys commands to British cruisers on occasions such as arose during last week? If the cable system is our assurance in peace, it will be a thousand times more our assurance and protection in war. In war, safety of communication must depend upon something less vulnerable than wireless telegraphy; for in war, though wireless telegraphy may be a useful secondary means of transmission, we should be foolish to put our faith in it for the transmission of momentous orders and decrees. It is altogether too fickle and capricious as an agent to decide the destiny of a British colony. We advocate, therefore, the extension of the inter-colonial telegraph cable system, and the storage of suitable lengths of submarine cable, at convenient stations.

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**National Physical Laboratory.**

We have found it necessary, on more than one occasion, to comment upon the dissatisfaction aroused amongst professional men with regard to the policy pursued by the National Physical Laboratory in connection with commercial testing. The trouble has arisen largely from the furnishing of confidential reports on apparatus and materials; it is argued that an Institution supported by the State—grudgingly and inadequately, it may be—is not justified in doing work for private persons unless the results become the property of the nation. There is no lack of skilled professional men ready and willing, for a consideration, to deal with the private tests above mentioned, and they undoubtedly have possessed a real grievance in this respect.

About a year ago a Committee was appointed by the Treasury to inquire generally into the work of the Laboratory, and the report was recently issued as a Parliamentary paper. The Committee remarks that the lines were correctly laid down by the Committee of 1898, and that the work of the Laboratory should include, not only research and standardisation, but also—*under proper restrictions*—the testing of materials. The essence of the matter lies in the words which we have italicised. As was inevitable, the Committee found evidence of strong feeling in connection with the possible interference with private enterprise and the publication of results; and although it regarded the fears of the private consultants and analysts as exaggerated, it agreed that they were not unreasonable or unfounded. The report therefore recommends that while the Laboratory should remain absolutely free with regard to "investigatory testing" it should be debarred from undertaking "contractual testing" (defined as the testing of materials to ascertain whether their properties are in accordance with the requirements of contracts) except in cases where the tests are such as cannot be carried out adequately, if at all, in existing private establishments, and in cases of dispute, where the Laboratory is invited by the parties or by a court of law to decide difficult questions. Government work is also to be allowed. Further, the fees charged for ordinary tests of this kind are to be at least as high as those normally current.

As regards the publication of results, the Committee leaves the executive free to withhold them for a limited number of years, but recommends that in such cases a considerably higher fee should be charged.

The Treasury and the Royal Society have approved of these recommendations, and the Executive Committee of the Laboratory has undertaken to carry them into effect. We hope, therefore, that the question may now be regarded as satisfactorily settled, and that harmonious relations between private practitioners and the National Laboratory will in future prevail.

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**Electrochemical Works in Switzerland.** — The Gotthardwerke A.-G. für Elektrochemische Industrie is the title of a new company which has been formed with headquarters at Bodio, Tessin, and with a share capital of £32,000. The object is to erect a factory in connection with the electricity works being established by the Motor Co. in the Biaschina, on the river Tessin, and to produce electrochemical and chemical products. Among the interested parties are the Motor Co. of Baden, the South German Discount Co., and the firm of L. Weil & Reinhardt, of Mannheim.

## NEW CARBON BRUSH GEAR FOR TURBO-DYNAMOS.

That carbon brushes should not be used on direct-current turbo-generators with cylindrical commutators, owing to the vibration and springing of the brushes, has hitherto been regarded by designers as an axiom, and in the majority of cases copper gauze or mixed copper gauze and carbon brushes have been employed.

The Morgan Crucible Co., however, claim that they have demonstrated that Morganite brushes, unaided by copper gauze brushes, can be employed with success in pneumatic brush holders on cylindrical commutators running at very high speeds. They have carried out experiments extending over about three years at their works at Battersea, with various forms of spring brush holders, but the results have always been more or less unsatisfactory. This was attributable to the failure of any spring to absorb continuously the excessively rapid vibrations that are at times set up even in the most perfectly constructed turbines.

The company's patent pneumatic brush gear is fitted to a 200-kw. Parsons turbo-generator in the company's power

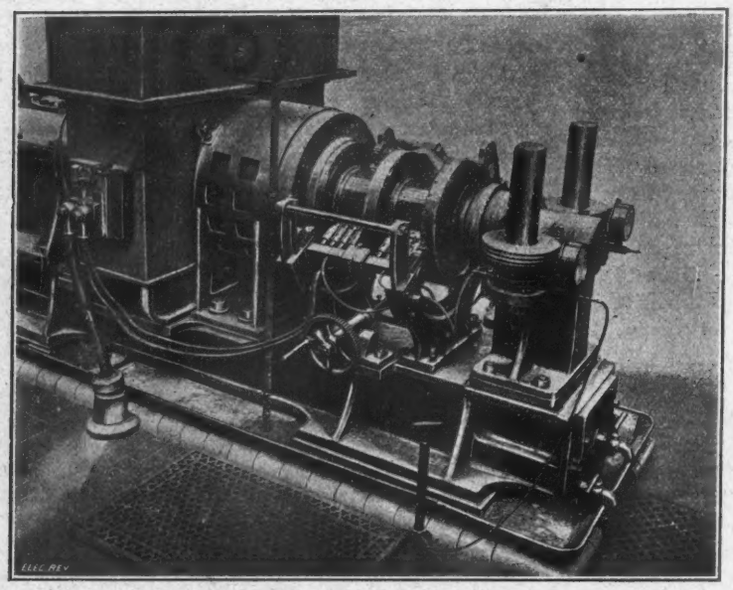

Fig. 1.—Aldershot Camp: Parsons Turbo-dynamo fitted with Pneumatic Brush-holders.

house. The generator was designed to give 1,800 amperes at 110 volts with gauze brushes, and runs at a speed of 3,300 r.p.m., the peripheral speed of the commutator being 7,860 ft. per minute. The field is provided with compensating windings of Messrs. Parsons's standard type. The position of the brushes is definitely fixed for all loads, no adjustment having been provided for the brush arms. This machine has been running at the Battersea Works day and night almost without cessation for the past 12 months, frequently carrying 2,000 amperes, without sparking, and the wear on the commutator is negligible. We visited the works a few weeks ago, and saw the machine running on load. The commutator was in perfect condition, while that of another turbo-generator close by, which had been running for only one-third as long, with gauze brushes, was severely worn down.

The pneumatic brush gear is of very simple construction. The air supply is brought from the small accumulators or reservoirs, shown on brackets at the end of the outboard bearing in fig. 1, to the square brass bar A shown in figs. 2 and 5, and the small air cylinders over each brush are screwed into this bar, thus ensuring perfect alignment.

Fig. 4 shows the detailed construction of the air cylinder. Within the outer casing C an inner tube slides freely, and the inflation of the rubber bag B causes pressure to be applied to the brush.

The inner tube carries a rod ending in a small conical insulator of porcelain I, which bears on the centre of the brush. By means of the air accumulators a constant and equal pressure is given to all the brushes, which ensures that each brush shall take its fair share of the load.

No trouble has been experienced due to the failure of the rubber bags or of any part of the air supply; but to prevent

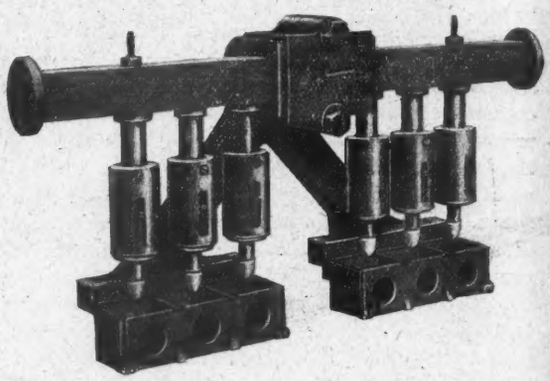

Fig. 2.—Bar fitted with Air-cylinders and Brush-holders.

the possibility of the pressure being removed from all the brushes at once, two accumulators are always provided, so that in the event of the failure of one, half the brushes remain in operation. A few strokes with an ordinary bicycle pump once a week are sufficient to maintain the pressure in the accumulator.

This type of pneumatic brush gear, with Morganite brushes, was fitted a few months ago to one of the turbo-generators in the Aldershot Camp Station,* under the direction of Mr. Mayne, the resident engineer. The machine is a 250-kw. Parsons generator, 450 volts, 555 amperes, and runs at a speed of 2,200 r.p.m. This generator is not provided with interpoles or compensating winding, and means have, therefore, been provided to vary the position of the brushes with the load.

In other respects the gear is identical with that described above. The commutator of this machine had been turned down several times, and the remaining useful life of the commutator with gauze brushes was very short. After a period of running and careful tests with Morganite brushes, it is estimated that

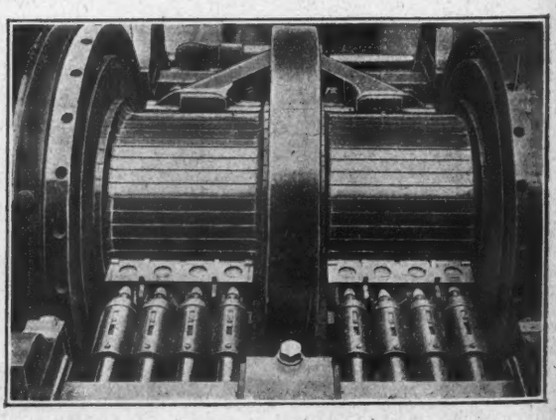

Fig. 3.—Commutator with Brushes in Position.

the commutator will now last 27 years—that is, of course, it will outlast the rest of the machine.

Mr. Mayne has authorised the publication of the results of two tests with different pressures on the brushes that he has recently carried out.

* For a description of this station see the Electrical Review May 29th, 1903.

| Pressure per sq. in. on brushes. | Load in amps. | Period of test. | Temperature rise on commutator. |
|---|---|---|---|
| 2·9 lb. | 550 | 5 hrs. 20 min. | 56° F. |
| 3·35 ,, | 550 | 5 hrs. 20 min. | 59° F. |

The "Morganite" brushes used on these machines are of standard types, and are provided with a metal top and four flexibles embedded in the brush in the process of manufacture. No solder is used, so that the connection between the brush and the flexibles is perfectly safe and most efficient.

An essential feature of these brushes besides their smooth and noiseless running is their extremely low coefficient of friction (0·15) which enables them to be used on commutators designed for gauze brushes, without increasing

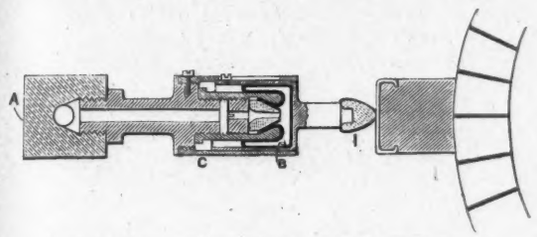


Fig. 4.—Longitudinal Section of Air Cylinder.

the temperature rise of the commutator. A perfect surface is developed on the commutator after a short period of running.

In addition to "Morganite" brushes, which are specially adapted for use on high-speed commutators and machines presenting special commutating difficulties, the Morgan Crucible Co. are now manufacturing on a large scale high-grade ordinary carbon "Battersea" brushes. The works, which are equipped with the most up-to-date plant for the manufacture of these brushes, are provided with chemical and electrical laboratories in which the brushes can be properly tested in various stages of manufacture, so as to ensure uniformity of quality, and a staff of experts is constantly at work with a view to improving the methods of manufacture and the quality of the product. British electrical manufacturers are, therefore, now in a position to secure the prompt delivery of English brushes of every grade, instead of having to purchase brushes from abroad.

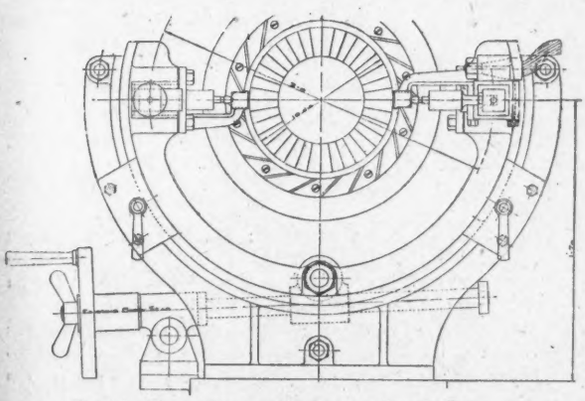

Fig. 5.—End View of Pneumatic Brush Gear.

One of the special features of the "Battersea" carbon brushes is the novel method by which the flexibles are attached. Discarding screwed and soldered joints, the makers drill the brush to a depth of about ½ in., insert the splayed-out flexible into the hole, and fix it firmly in position by means of a pure metallic powder compressed in place with great force. The flexible can thus be attached at any point, with the minimum of resistance, cannot be melted or pulled out, is flexible where it leaves the brush, and can be used again. In the case of "Morganite" brushes, the connection is made with a metal cap forming part of the brush, as explained above.

**Sandown (I. of W.).**—The U.D.C. on March 18th decided to accept the tender of the E.L. Co. for public lighting.

## CORRESPONDENCE.

*Letters received by us after* **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Economical Arc Lighting.

I thank Mr. Duncan Watson for his criticism of my views with reference to the above, and I trust that I shall still learn a great deal in the study of efficient lighting, as this very important question has not sufficiently occupied the attention of electrical engineers as to be in any way near perfection. I can assure Mr. Duncan Watson that any tips he can give *re* this will be heartily welcomed by all station engineers and consumers, and the task of the former would be considerably lightened when the latter's accounts are being settled. Had I left these particular jobs to the aged inactivity of some wiring contractors rather than employ the youthful buoyancy which Mr. Duncan Watson gives me credit for, his name or that of any other contractor would never have been seen in connection with the installation, and the high-pressure gas lamps would still have been throwing their iridescent glare.

We all have our pet ideas of how to use artificial illumination, some bad and some good, and he is a sorry individual who cannot frame some idea of how and with what to light an interior. The wild statements which I presume Mr. Duncan Watson accuses me of making, to which I plead guilty, were :—

1. That it is not a very satisfactory job to run six or even five 5-amp. open type lamps in series on 230 volts D.C.

2. That it is not a very satisfactory job to run a 5-amp. open type lamp in series with two enclosed lamps in series on 230 volts D.C.

Mr. Duncan Watson in his previous letter agrees with me in both items, but he did not at the time, as he assured me type that in the West End he had hundreds of 5-amp. open lamps running as mentioned, and hence his good-natured piloting; and I must say that the jobs he showed me were very satisfactory, but I maintain they were not 5-ampere lamps. If they were, why does your correspondent say in his previous letter that 5-amp. open type lamps are not satisfactory?

With reference to the wild statement No. 2, Mr. Duncan Watson also agrees with me, though he did not at the time. In fact, the particular shop was lighted throughout with 5-ampere, not 7-ampere, enclosed lamps, and your correspondent assured this tradesman that he could make use of the wasted energy being used in the resistances. Of course he could, but I maintained at the time that it would not be satisfactory, and it was not.

I thank Mr. Watson for telling me that the lamp he always used was a brake-fed enclosed lamp, and works admirably in series with open type lamps; if that is so, why does he say in his previous letter that after years of "careful investigation" he has reluctantly come to the conclusion that the running of open type lamps in series with enclosed lamps is undesirable? I would beg to point out to Mr. Watson that the mechanical means of striking the arc is not the only thing which controls the feed of an enclosed arc lamp, and as the majority of arc lamp makers are making enclosed lamps to run in series without the complication of shunt coils or brake-fed carbons, I do not think it necessary to discuss the relative merits of each system. Sufficient to say, that the lamp I was interested in at the time, and am still, is one of the best on the market, but I am not interested in the same way as your correspondent was in the particular lamp he mentions and was trying to sell.

I would also point out to Mr. Duncan Watson that the running of flame arcs in series with enclosed lamps *is* a highly satisfactory job, and was not mentioned by any third party at this interview, and this system is *not* analogous with running standard 5 amp. enclosed lamps in series with 5-amp. open type lamps, and *is* of real practical value to consumers who only want two flames for outside lighting; and if Mr. Duncan Watson would like to see this system running I would, in return, good-naturedly conduct him.

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Granted that your correspondent did not suggest adjusting a 5-amp. lamp to 4-amp. He certainly suggested increasing the length of the arc to reduce the current in the neighbourhood of 4 amps. If it is a 6-amp. or 7-amp. lamp, all the more impracticable the suggestion. I regret to have taken up so much of your valuable space, but feel that I cannot let Mr. Duncan Watson's letter pass without some reply, as it would certainly seem that one of us is handling the truth very roughly, and I would be pleased if Mr. Duncan Watson would publish any other "wild statements" he accuses me of making.

**A. C. Bostel.**

Birmingham, *March 16th*, 1908.

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### Home Office Regulations Inquiry.

May I be permitted to draw attention to a peculiar point in your report of the Home Office inquiry. There is no obvious fault to find with Regulation 12, as every engineer should know that very reliable automatic no-volt releases for alternating-current motors have been on the market for some time. From a safety point of view, as far as the motor is concerned, it is immaterial whether the switch is near the motor or far from it, but considering the safety of those working on or near the motor, the automatic no-volt release loses its advantages if the control is remote.

I take it that Home Office regulations are formulated principally to ensure the greatest possible immunity from personal injury. It is the duty of manufacturers and consumers to look after the welfare of their machinery.

**W. G. Rhodes, D.Sc., M.I.E.E.**

Manchester,
*March 17th*, 1908.

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### Commercialism and Electrical Practice.

In the reply of your reviewer to my former letter, appearing in your issue of 6th inst., I note the following remark. After quoting a statement from my preface—that the book was written for practical men by a practical man—your reviewer continues: "Now I venture to suggest that, however distasteful commercialism may be to the author, it is the determining factor which rules and limits practicability." Later on your reviewer states that the system I recommend, "leading a separate pair of wires from a fuseboard to each individual light, cannot be done at competition prices. To that statement I still adhere; it is backed by ten years and more of competition prices."

I beg to submit that the above, if it means anything, means the advocacy of a very dangerous practice indeed, and one that should hardly have the support of a leading technical journal. According to your reviewer's statement, competition prices are to rule the quality and the arrangement of apparatus that are employed in electrical work. If your reviewer's remarks mean anything, they mean this. Putting on one side for the moment the question whether his view or mine, as to the danger of the looping-in system, is correct, and assuming for the moment that my view is correct, and that the looping-in system is dangerous, according to your reviewer's argument, the system is to be employed, if competition prices demand it, notwithstanding its danger. I think if we carry the matter a little farther, we shall see what a very dangerous, and may I say, foolish argument, in the best interests of the electrical industry your reviewer has raised. I presume that your reviewer will agree with me that it is unsafe to allow more than a certain density of current in conductors employed for an electric light or power service inside a building; and further, that it is unsafe to employ conductors that are not properly insulated and efficiently protected from mechanical injury and from wet. Yet, according to his argument, if competition prices rule that higher density of current than is safe, or inferior insulation and protection are all that can be allowed, contractors are not only justified, but are bound to fix wires in accordance with those requirements and more, those who sit in judgment, such as your reviewer, are justified in upholding them in the practice.

I think, sir, that the argument needs only to be stated in the above form to show its absurdity, and I venture to think that your reviewer's ten years' experience will have taught him that bad work is always bad, and never really cheap.

I venture to think that your reviewer has mixed up two questions, the economical question and the engineering question. No industry can exist unless it can make a sufficient profit to pay its expenses, and the interest demanded for the use of the capital employed in it, and no firm can continue to exist unless it also makes a profit by its transactions, sufficient to pay its expenses, and to give a living to those engaged in it. But I am only uttering a truism, that I feel sure your reviewer's ten years' experience will confirm, when I say that bad work, and in the case of wiring for electric lamps, &c., unsafe work, can only injure the industry as a whole, and can only injure the individual firm who adopt it, however much they may profit temporarily by meeting the competition prices.

In my 30 odd years' experience, for over 20 of which I conducted a pioneer electrical business, I had constantly to meet competition prices, prices that were often as low as 25 per cent. of those at which the work could be efficiently done. I venture to think that your reviewer would hardly have recommended me to meet the competition prices in the way that he suggests.

**Sydney F. Walker.**

Bath, *March 17th*, 1908.

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### Generating Station Engineers.

If Mr. Frank Ayton particularly desires marine men as shift engineers, and he has the appointing of the staff, he will, of course, take on just what men his own particular fancy dictates. We all have our own particular preferences, and I can only congratulate Mr. Ayton on being able to exercise his; but, if he would avoid personalities, which, unfortunately, so many are so eager to indulge in, he would be well advised not to wear his heart on his sleeve, and to keep his own counsel about what are, after all, his own individual peculiarities. He would have saved himself then his column of explanation.

Anyway, he is to be thanked for letting us of the "non-marine" breed know that we shall see no "Welcome" on the mat at Ipswich.

**Jaybird.**

Walworth.

[This correspondence is now closed.—Eds. E.R.]

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### Peak Batteries.

In your issue of to-day there appears a letter from Mr. A. D. Stevenson, headed as above, stating that such batteries, when for lighting purposes, cannot commercially be worked.

I am content to admit that there is no large margin of profit in operating a battery for lighting purposes, when the size of the installation is small; but 100 kw. is quite a good size, and I feel quite sure that, on the system I have put forward for "power," a case could be made out for an installation of this size, even if used only for lighting.

Everything depends on:—(1) The charge made for the current; (2) the capital cost of the battery itself (without accessories); (3) the allowance for attendance; (4) the floor space required for the battery.

If Mr. Stevenson has tackled this problem on what I may call the regular lines, I can understand his conclusions; but if he will consider the margin between the costs given in fig. B on page 405, of part 185 of the I.E.E. *Journal* (1907), and those given on fig. 9 on page 386 of that journal (which are, however, for *power*), he will see that there is enough to pay for current at ¼d. per unit, and have a *liberal* margin to spare.

The question of the "equivalent" period of maximum discharge of the cells is an all-important one, and I regret that I am too pressed for time to consider it here; I am, however, doing so rather fully in a forthcoming paper to be read on the subject in June next.

As regards fogs, the question whether any provision at all need be made for these depend entirely upon the town where the batteries are installed, and the extent to which the use of accumulator installations would be countenanced by the supply authority; but this question, again, might be hardly

of sufficient general interest to your readers to take up—just now, anyhow.

If Mr. Stevenson will (1) third the cost of his battery; (2) third the floor space required; (3) knock out attendance almost entirely; and (4) halve the cost of his current, he will, I anticipate, be working nearer to the lines which I believe are practicable, and will probably find that he *can* show a saving by putting in the cells.

I do not know that I am called upon at the present time to explain how the above ecomomies might, in my opinion, be effected; it is, however, some satisfaction to me to know that several municipal engineers, besides Mr. Bowden, are believers in the proposals I have made, and hope ere long to be carrying out.

**A. M. Taylor.**

King's Heath, *March 20th*, 1908.

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### Time Switches.

Referring to your article on "Publicity for Small Undertakings," we think the author is rather unfair to time switches, and is evidently basing his remarks on old experience. If he would kindly put himself in communication with us, we should be happy to prove to him that *our* switches, at all events, do not deserve his condemnation. We think that the replies which many central station engineers were kind enough to send to your paper some time back in answer to a query in the "Correspondence" columns go a long way to prove this.

**Venner & Co.**

London, S.W., *March 24th*, 1908.

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### Correspondence Schools.

Your remarks under the heading of "Educational Exhibition," on page 448 of your issue of March 13th, lead me to offer one or two remarks on the kind of instruction offered by these schools.

A short time ago I was requested by several apprentices and wiremen to advise them, and give them my opinion as to the benefits likely to be derived from taking a course of lessons from one or other of these schools. I perused a good deal of literature which they had obtained showing the nature of the teaching given, from which I gathered that the instruction is very largely, if not wholly, descriptive of American methods—the circulars containing practically no mention of English machines, apparatus or practice. For instance, under the heading of "Dynamo and Dynamo Design," the only machines mentioned are the unipolar, Brush constant-current and the Thomson-Houston constant-current machines, all of which are very interesting dynamos, but which in this country are almost non-existent, and certainly from a practical experience in the running of both these C.C. machines, it requires an attendant with far more knowledge than will be gained from a dynamo-running course to safely operate a T.H. arc lighter.

Again the wire gauge tables given are those of B. & S.—a gauge which is never used here in practical work.

Under the heading of "Arc Lighting" there does not appear to be a single English lamp described, and, in fact, all through the syllabus one is struck by the absence of anything English. This, I think, is a great pity, as doubtless many young fellows will, partly by reason of your commendation, be induced to join one or other of these schools in the hope that as soon as they have gone through the selected course, they will receive one of the highly paid vacancies which are supposed to be waiting for all "trained" men. It may be that there are numerous vacancies of this kind, but, if so, they certainly will not be filled up by men who have little to show but a diploma from a correspondence school, yet this, unfortunately, is according to the advertisements, practically all that is required.

Some portion of the information gained from any one of these electrical courses is no doubt of some benefit to men who are already engaged in practical work, and whose general education has been somewhat neglected, but it is much to be regretted that the impression is given that anyone who can read and write can, by spending, say, £8 to £12 on a short course, qualify himself for a good position in the electrical world. The shoals of replies one receives from practical men in answer to an advertisement for a wireman, dynamo attendant or station engineer, is proof positive that the man with only a paper education stands but little chance of obtaining a job at 10s. per week, much less the wage of an ordinary attendant or wireman.

For young fellows who intend becoming electrical engineers (?), and who are anxious to get an idea what the prospects are, I can recommend no better course than to study the "Situations Vacant and Wanted" columns of the Electrical Review for three months. I think that at the end of that period most of them will have learned all they want to know about electrical engineering.

**W. H. B.**

[Our correspondent is hardly fair to the system in question; we have examined many of the text-books, and found them excellent—apparently he has only seen excerpts. We always have said that when direct instruction cannot be obtained, tuition by correspondence is very useful. It should not be forgotten that the men who adopt this last resource are the keen men, who are determined to acquire knowledge, and are therefore likely to prove good students.—Eds. E.R.]

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### Trucks and Permanent Way Maintenance.

The article entitled "Trucks and Permanent Way Maintenance" by Mr. F. W. Leevers in your issue of March 13th, 1908, shows a masterful method of handling the subject, which everyone of your readers interested in traction would do well to emulate.

Rail corrugation has been treated as a disease, when it is really nothing more than a symptom. The ridiculous attempts which have been made to suppress such symptoms as rail corrugation, faulty rail joints, rolling and swaying of cars, and the costly cutting away of points, curves and straight track, remind one very forcibly of the old cures of leeching and bleeding, &c., which puzzled medical men practised, until science, with its precision, became the recognised authority. To-day we realise that it *is* faulty truck design—and *radically incorrect* design at that, which gives the abominably crude series of interactions between the mass of the car and the track, the symptoms of which are so inscrutable to the overworked executive officers of the average tramway system.

Mr. Leevers is probably not aware that there is no real quibble over my term, the "conformity line" (the trajectory of traction). It is true that some time ago I was attacked by a gentleman who contributes to a number of technical journals, but that gentleman has long since been so kind and so courageous as to admit that he thought I was speaking of curves, and that he quite sees that on straight track the car-body can make a straighter line than the track.

I am glad to see that Mr. Leevers recommends those interested to put their own construction upon the term I use to define this straighter line.

My immediate object in addressing you on this subject is to call attention to the remarkable recommendation which I find in the *Times* Engineering Supplement Electrical Notes of March 18th, 1908. I give an extract, which reads as follows:—"And it has latterly been found as the result of experiments with so-called 'radial' trucks that on a great many tramway systems the management might have with great advantage used trucks with longer wheel base without any consideration of ingenious but expensive methods of enabling the trucks to run on curves. At the present time, in fact, excellent results are being obtained by the locking of the 'radial' motion in certain towns that have adopted these trucks; and it is fully proved that what are called rigid axle trucks with a wheel base as long as 8 ft. 6 in. can be made to travel easily round any ordinary curve."

The writer also speaks of the languid interest throughout the tramway business, shown in the work of various inventors. This last statement is a gross libel upon the tramway managers and engineers, whose enterprise I can vouch for as foremost of that in any British industry. Sixty pounds was the price paid for American trucks. British manufacturers offered the radial trucks for about £100, and some 600 were sold. Just how the manufacturers justified the trust reposed in them by the tramway managers we will pass over, but to

speak of the keenness and enterprise of the tramway managers in paying practically double price in order to have good trucks, as a languid interest, indicates a lamentable want of knowledge, or else a distortion of the true facts.

I am aware that a large number of these radial trucks are being run blocked up and practically rigid, while others have been taken off the roads entirely. This, however, is an expedient adopted by the tramways since it was impossible for them to immediately scrap what were practically new trucks. It is quite a different thing to recommend the building of a rigid 8 ft. 6 in. wheel base truck.

Anyone who has examined the recently renewed curve at the corner of Westminster Bridge, over which no wheel base exceeding 6 ft. 6 in. ever passes, and the majority are 4 ft. 6 in. parallel axle bogies, will agree, as every sane tramway manager has long ago agreed, that the recommendation which I quoted above is not only monstrous but is a menace to public safety.

Some time ago I carried out by request, in the dead of night, on a measured half mile of almost new straight track, on the West Ham Corporation Tramways, the times and speeds being kept practically the same on each run, a number of trips on a radial truck, which we alternately locked rigid, and left free to swing on my circular swinging links. Some half-dozen observers, including Mr. H. E. Blain, the general manager, remarked quite independently of each other that when the truck was locked rigid, in spite of the fact that the speed was the same, the car *seemed* to go twice as fast. I should say then that if you wish your passengers to imagine that they are travelling twice as fast as they really are, and to cause the car to vibrate and chatter, so that the passengers cannot hear themselves chatter, but rather get a severe headache, the proper thing to do would be to lock your radial trucks in the manner recommended by the correspondent to the *Times*.

The main objection I personally see to treating your passengers in this inhuman manner is that the track maintenance and wheel maintenance is apt to prove too costly an item.

**J. Sutherland Warner.**

Westminster, *March 23rd*, 1908.

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### Proposed Engineers' Association.

In reference to the letter of Mr. Alfred E. Penn, may I point out that tne "Association of Engineers-in-Charge" is not at all the kind of organisation that central station engineers require in order to remedy the bad state of affairs in the central station line. To begin with, the aim of the Association of Engineers-in-Charge is very largely educational; this although an excellent point is *not* the point we are at present concerned about. What we require is a strongly organised body which will have for its sole aim the betterment of salaries and conditions of work in our profession; there are various societies which we can join for educational purposes and for the exchanging of experiences, but none of these societies will take up the case of a shift engineer, say, who has been wrongly blamed by his chief in order to cover up the latter's mistakes, and who has been made to suffer for another's error. Now such cases are by no means uncommon, and the majority of station engineers in assistant positions are very badly paid.

Again, the fact that one of the greatest of central station engineers is president of the Association of Engineers-in-Charge, is *not* a recommendation to central station engineers to join and use the Association to better their prospects; for, Mr. Editor, it must be regretfully admitted that the leading men in our profession are amongst those who pay and treat their assistants the worst. No, what we require is to throw aside all false dignity and to admit straightaway that we require a trade union at the back of us, not of the ever irritating type of some of the well-known trade unions which do more harm than good, but a good strong professional organisation such as the Law Society is, which must act not by strikes but by moral persuasion of committees, &c., by warning engineers not to go to places know to be badly paid and by refusing them all further help should they do so; by being exceedingly particular as to whom we admit to membership, and by bearing in mind the fact that those of us who first join will most likely have to face two things, these being: first, that we shall have to lose some money to set matters going, and secondly that we cannot hope to see any results for at least 12 months or two years at the earliest.

I shall be glad if you will forward my name to "Organiser" in time for the Wednesday meeting, and I shall be glad to hear all particulars, and to do what I can to help matters. I cannot get to the meeting, but can assure him of any practical help I can possibly render. Any scheme for inviting a number of prominent central station chiefs to lead off the organisation I will not join, as it is these people we have to fight.

**Combine.**

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It is well known that engineers must be strong nerved for all the various items which befall them from day to day whilst on duty, not forgetting committee day, and the questions asked them. I have often been un-nerved at the various peculiar items which I have read in the papers, from persons being asked to give their services for nothing, upwards; but taking the *Daily Chronicle* of the 18th inst., under the heading of "Interesting New in Few Lines," I take exception to this passage, which for the benefit of those who did not read it, I will reproduce:—

"Barber as Engineer.—The Westminster Guardians have selected the workhouse barber to act as assistant engineer at a slightly increased salary. After shaving the inmates of the workhouse he will assist the engineer, and have control of the engines during the absence of the chief engineer."

It would be interesting to know what the chief's views are of this compound appointment, as no doubt during his absence the familiar "Pole" (not + or —) will adorn the entrance to his engine room so as to direct the inmates where the barber—I mean assistant engineer—is "doing" duty.

To the ordinary reader this sounds like a joke, but to those in the profession, and especially those engaged in the engineering section of our public institutions, it strikes a very deep note. When we have people like the Westminster Guardians, right in the heart of London, doing this sort of thing, can we tell what will happen next?

It is no argument to say, "Oh, they have only got so and so, not much stuff to look after there."

The point I wish to bring out is that engineers, whether they be assistant or the engineer-in-charge, should be raised a great deal higher as regards their position, and regarded as more than a sort of "necessary evil."

Now I have read and watched with interest the proposed new association for engineers. I do not wish to write for or against this proposal, only we have already an Association of Engineers-in-Charge whose chief aim, I am led to believe, is to help all those in the profession; perhaps, those whose ideas they do not strike, will now come forward and state their views so that this association may be the *one* where help can be looked for, as we know *unity* is strength, and where omissions in their general conditions are left out, it would give the Committee a chance to consider any such proposals, rectify, and to gain a large number who are still out of the folds. I am one of those who have not seen their way clear to join the Association. I quite agree that valuable papers are given so as to educate the mind, &c., but thanks to the Electrical Review, having been a constant reader of this valuable paper, the abstracts given by this and other technical journals keep one very well posted up.

My idea is that we require an association such as we have already, but it must be strong enough to act as a sort of intermediary between employed and employers, in so far that if we had a real grievance we could lay our case before a select committee, and if such were justified, they in turn would, in a diplomatic manner, bring the matter to the notice of the authority, &c., that were at fault.

Again, the wages question should be taken up, and this, too, by the same association, and the fact of being a member should be a testimonial of efficiency when one was applying for a higher post.

**Disgusted.**

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In his last letter, "Electricity Supply" has mentioned what seems to me the chief difficulty to be solved; the means of ascertaining the qualifications of prospective

members. I would suggest that the following form a basis to work upon :—

(*a*) A definite minimum number of years of technical experience, including college and shop work.

(*b*) Extent of personal responsibility of applicant at time of application.

(*c*) An examination, to be held preferably by the Board of Trade, and certificates granted accordingly.

The actual values assigned to the first two of the above will have to be chosen with very great care, so as to be scrupulously fair to all concerned. I think the granting of certificates by the Board of Trade would reap its own reward in time, without legislation compelling supply undertakings to employ only certified men.

I would suggest, before anything is definitely settled, that the invitation of the Association of Engineers-in-Charge, conveyed through the letter of Mr. Alf. E. Penn, should be accepted. Surely it would be to our mutual advantage to co-operate with the above society, if by so doing we can further our interests.

**South Shift.**

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### Bulk Supply.

Messrs. J. Horace Bowden and Fred Tait, in their articles on the above subject, propose that a large central plant should be put down to serve as a common standby for all the London supply systems. They express the opinion that the only plant which can economically be centralised is the standby and reserve plant.

Suppose that their suggestion were adopted. The new central plant would be a modern one, with very large units, and every attendant feature conducive to economical generation. The running—as distinct from capital—costs would be far lower than those attainable in the smaller stations to which it served as standby; as a result, it would very soon be found most economical to generate as many units as possible in the central plant, and to keep the local stations in reserve and for taking peaks.

This would, of course, be directly opposed to the views of your contributors, who insist that the new bulk station should only contain the spare plant!

The Central E.S. Co. is a case in point, as their station was at first regarded only as a stand-by by the St. James' Co. But it was soon found that Grove Road could generate cheaper than Carnaby Street, and the latter museum has now come to be regarded as the stand-by.

Further overwhelming proof of the fallacy of your contributors' views is furnished by the experience of the Charing Cross Co., the Manchester Corporation, the Newcastle Co. and many others.

But surely such proof is unnecessary.

**Six-phase.**

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Stabilite.—Wholesale suppliers would like to know where they can obtain Stabilite.

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**Electric Fire Engines in Berlin.**—The city of Berlin granted a sum of £2,500 in March, 1906, for the purpose of experiments being made with self-propelled fire engines, and Herr Reichel, the chief of the fire brigade, decided to have a steam engine and an electromobile built for the purpose. Both vehicles have been subjected to long-distance runs, and the results are embodied in a report recently issued by the chief officer. As far as the electric fire engine is concerned, Herr Reichel states that as a rule it was taken on two journeys daily. The runs were not merely limited to the city and suburban districts, but were extended to numerous localities situated at a distance of from 22 to 25 miles from Berlin. For instance, journeys were repeatedly made to Oranienburg, Zossen, Bernau, Potsdam, &c. The principal object of these distant runs was to thoroughly test the motors and the battery on roads having gradients and badly paved. The motors enabled the engine to mount all gradients admirably. During a single week in June, 1907, the vehicle covered a distance of 611 miles, that is to say, almost the same mileage as is traversed by a horsed steam fire engine on an average in a year—620 miles. The chief officer has now resolved, as a result of the experiments, to introduce electric fire engines for use in the inner parts of the city and the near suburbs, leaving steam motor fire engines for employment beyond those districts.

## HOME OFFICE INQUIRY.

The inquiry into the proposed Home Office Regulations was resumed before Mr. Swinburne, the Commissioner, on Monday, March 16th. Very little evidence was taken on that day. Mr. Trotter was called to explain that the Board of Trade proposed to withdraw certain regulations, which, it was thought, might overlap the Home Office Regulations, and Mr. Garside, of Engineering Instruments, Ltd., was called for the purpose of showing that alternating-current motors with no-volt release attachment were in commercial use.

As it was obvious that to offer evidence upon every individual Rule, and subject witnesses to cross-examination by the whole of the representatives of some 180 objectors, would tend to unduly prolong the inquiry, it was agreed that an informal conference should be held between representatives of both sides, to decide as to what points they could agree upon. This conference lasted for several days, and as a result modified regulations as set out below were agreed upon.

The inquiry was adjourned until Tuesday last, the 24th inst. when counsel for the various parties addressed the Commissioner on the points raised by their advisers.

The original draft regulations will be found in the Electrical Review for August 30th, 1907, page 329.

### Definitions.

"Pressure" means the difference of electrical potential between any two conductors, or between a conductor and earth, as read by a hot-wire or electrostatic voltmeter.

"Low pressure" means a pressure normally not exceeding 250 volts.

"Medium pressure" means a pressure normally above 250 volts, but not exceeding 650 volts.

"High pressure" means a pressure normally above 650 volts, but not exceeding 3,000 volts.

"Extra high pressure" means a pressure normally exceeding 3,000 volts.

"System" means an electrical system in which all the conductors and apparatus are electrically connected to a common source of electromotive force.

"Conductor" means an electrical conductor arranged to be electrically connected to a system.

"Apparatus" means electrical apparatus, and includes all apparatus, machines, and fittings in which conductors are used, or of which they form a part.

Definition of "cable" deleted.

"Circuit" means an electrical circuit forming a system or branch of a system.

"Insulating stand" means a floor, platform, stand or mat
"Insulating screen" means a screen
"Insulating boots" means boots
"Insulating gloves" means gloves
} of such size, quality and construction, according to the circumstances of the use thereof, that a person is thereby adequately protected from danger.

"Covered with insulating material" means adequately covered with insulating material of such quality and thickness that there is no danger.

"Bare" means not covered with insulating material.

"Live" means electrically charged.

"Dead" means at, or about, zero potential, and disconnected from any live system.

"Earthed" means connected to the general mass of earth in such manner as will ensure at all times an immediate discharge of electrical energy without danger.

"Sub-station" means any premises, or that part of any premises, in which electrical energy is transformed or converted, and which are large enough for a person to enter after the apparatus is in position.

### Exemptions.

1. Nothing in these Regulations shall apply to any system the normal working pressure of which does not exceed 130 volts continuous or 65 volts alternating.

2. Nothing in Regulations 7, 8, 9 and 10 shall apply in electrical stations to any circuit or conductors used for conveying electrical energy for public supply or for traction under licence or other statutory powers, or for railway purposes.

3. Nothing in Regulation 12 shall apply to any motor of a motor-generator or to any motor forming part of any electrical converter, regulator or similar apparatus.

4. Nothing in these Regulations shall apply on the premises of an occupier, being a consumer of an authorised electricity supply undertaking, to any service lines or apparatus on the supply side of the occupier's terminals, belonging to and under the control of the suppliers, provided such suppliers are subject to Board of Trade Regulations in respect of such supply.

5. If the occupier can show with regard to any requirement of these Regulations that the special conditions in his premises are such as to adequately prevent danger that requirement shall be deemed to be satisfied.

6. Nothing in these Regulations shall apply to any process or apparatus used exclusively for electro-chemical or electro-thermal

or testing or research purposes; provided such process be so worked and such apparatus so constructed and protected, and such special precautions taken as may be necessary to prevent danger.

Regulations.

1. All apparatus and conductors shall be sufficient in size and power for the work they are called upon to do, and so constructed, installed, protected, worked and maintained as to prevent danger so far as is reasonably practicable.

2. All conductors shall either be covered with insulating material, and further efficiently protected where necessary, or they shall be so placed and safeguarded as to prevent danger so far as is reasonably practicable.

3. Every switch, circuit-breaker, and isolating link shall be:—(*a*) So constructed, placed, or protected as to prevent danger; (*b*) so constructed and adjusted as accurately to make and to maintain good contact; (*c*) provided with an efficient handle or other means of working, insulated from the system, and so arranged that the hand cannot inadvertently touch live metal; (*d*) so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

4. Every switch intended to be used for breaking a circuit and every circuit-breaker shall be so constructed that it cannot be inadvertently left in partial contact.

Every switch intended to be used for breaking a circuit and every circuit-breaker shall be so constructed that an arc cannot accidentally be maintained.

5. Every fuse and automatic circuit-breaker used instead thereof shall be so constructed and arranged as effectively to interrupt the current before it so exceeds the working rate as to involve danger. It shall be of such construction or be so guarded or placed as to prevent danger from over-heating, or from arcing or the scattering of hot metal or other substance when it comes into operation. Every fuse shall be either of such construction or so protected by a switch that the fusible metal may be readily renewed without danger.

6. Every electrical joint and connection shall be of proper construction as regards conductivity, insulation, mechanical strength and protection.

7. Efficient means, suitably located, shall be provided for cutting off all pressure from every part of a system, as may be necessary to prevent danger.

8. Efficient means suitably located shall be provided for protecting from excess of current every part of a system, as may be necessary to prevent danger.

9. Where one of the conductors of a system is connected to earth, no single-pole switch other than a link for testing purposes or a switch for use in controlling a generator shall be placed in such conductor or any branch thereof.

10. Where one of the main conductors of a system is bare and uninsulated, such as a bare return of a concentric system, no switch, fuse, or circuit-breaker shall be placed in that conductor, or in any conductor connected thereto, and the said conductor shall be earthed.

11. Every motor, converter and transformer shall be protected by efficient means suitably placed, and so connected that all pressure may thereby be cut off therefrom and from any apparatus in connection therewith, provided, however, that where one point of the system is connected to earth, there shall be no obligation to disconnect on that side of the system which is connected to earth.

12. Every electrical motor shall be controlled by an efficient switch or switches for starting and stopping, so placed as to be easily worked by the person in charge of the motor.

To prevent danger through the automatic re-starting of a motor, every electrical motor or group of electrical motors shall be protected by a release which will automatically break the circuit if the current is interrupted, such release being suitably placed with regard to the danger to be prevented. Provided that no release shall be required for any motor which has an attendant constantly at the controller of such motor while at work.

In every place in which machinery is being driven by any electric motor, there shall be means at hand for either switching off the motor or stopping the machinery.

13. Every flexible wire for portable apparatus shall be connected in a system either by efficient permanent joints or connections, or by a properly constructed connector.

Adequate precautions shall be taken against shock due to leakage or other cause in all places where the person handling the portable apparatus is not insulated from earth.

In such places and in any place where the pressure exceeds low pressure, the portable apparatus and its flexible wire shall be controlled by sufficient means suitably located, and capable of cutting off the pressure.

14. The general arrangement of switchboards shall, so far as reasonably practicable, be such that:—

(*a*) All parts which may have to be adjusted or handled are readily accessible.

(*b*) The course of every conductor may where necessary be readily traced.

(*c*) Conductors not arranged for connection to the same system are kept well apart and can when necessary be readily distinguished.

(*d*) All bare conductors are so placed or protected as to prevent danger from accidental short circuit.

15. Every switchboard having bare conductors normally so exposed that they may be touched, shall be located in an area or areas set apart for the purposes thereof or where necessary suitably fenced or enclosed.

No person except an authorised person, or a person acting under his immediate supervision, shall for the purpose of carrying out his duties have access to any part of such area.

16. All apparatus appertaining to a switchboard and requiring handling, shall so far as practicable be so placed or arranged as to be operated from the working platform of the switchboard, and all measuring instruments and indicators connected therewith shall, so far as practicable, be so placed as to be observed from the working platform. If such apparatus be worked or observed from any other place, adequate precautions shall be taken to prevent danger.

17. At the working platform of every switchboard and in every switchboard passage way, if there be bare conductors exposed or arranged to be exposed when live so that they may be touched, there shall be a clear and unobstructed passage of ample width and height with a firm and even floor. Adequate means of access, free from danger, shall be provided for every switchboard passage way.

The following provisions shall apply to all such switchboard working platforms and passage ways constructed after January 1st, 1909, unless the bare conductors, whether overhead or at the sides of the passage way, are otherwise adequately protected against danger by divisions or screens or other suitable means:—

(*a*) Those constructed for low-pressure and medium-pressure switchboards shall have a clear height of not less than 7 ft., and a clear width measured from bare conductor of not less than 3 ft.

(*b*) Those constructed for high-pressure and extra high-pressure switchboards other than operating desks or panels working solely at low-pressure shall have a clear height of not less than 8 ft. and a clear width measured from bare conductor of not less than 3 ft. 6 in.

(*c*) Bare conductors shall not be exposed on both sides of the switchboard passage way unless either the clear width of the passage is in the case of low-pressure and medium-pressure not less than 4 ft. 6 in., and in the case of high-pressure and extra high-pressure not less than 8 ft., in each case measured between bare conductors, or the conductors on one side are so guarded that they cannot be accidentally touched.

18. In every switchboard for high-pressure or extra high-pressure:—

(*a*) Every high-pressure and extra high-pressure switchboard conductor within reach from the working platform or in any switchboard passage way shall be so placed or protected as to prevent danger.

(*b*) The metal cases of all instruments working at high-pressure or extra high-pressure shall be either earthed or completely enclosed with insulating covers.

(*c*) All metal handles of high-pressure and extra high-pressure switches, and, where necessary to prevent danger, all metal gear for working the switches shall be earthed.

19. All parts of generators, motors, transformers or other similar apparatus, at high-pressure or extra high-pressure, and within reach from any position in which any person employed may require to be, shall be, so far as reasonably practicable, so protected as to prevent danger.

20. Where a high-pressure or extra high-pressure supply is transformed for use at a lower pressure, suitable provision shall be made to guard against danger by reason of the lower pressure system becoming accidentally charged above its normal pressure by leakage or contact from the higher-pressure system.

21. Where necessary to prevent danger, adequate precautions shall be taken either by earthing or by other suitable means to prevent any metal other than the conductor from becoming electrically charged.

22. Adequate precautions shall be taken to prevent any conductor or apparatus from being accidentally and inadvertently electrically charged when persons are working thereon.

23. When necessary to prevent danger, insulating stands or screens shall be provided and kept permanently in position, and shall be maintained in sound condition.

24. Portable insulating stands, screens, boots, gloves or other suitable means shall be provided and used when necessary to prevent danger, and shall be periodically examined by an authorised person.

25. Adequate working space and means of access, free from danger, shall be provided for all apparatus that has to be worked or attended to by any person.

26. All those parts of premises in which apparatus is placed shall be adequately lighted to prevent danger.

27. All conductors and apparatus exposed to the weather, wet, corrosion or to inflammable surroundings or explosive atmosphere, or used in any process or for any special purpose than for lighting or power, shall be so constructed or protected, and such special precautions shall be taken as may be necessary to prevent danger in view of that exposure or use.

[Regulation 28 deleted.]

29. No person except an authorised person, or a person acting under his immediate supervision, shall undertake any work where technical knowledge or experience is required in order to avoid danger.

Where a contractor is employed, and the danger to be avoided is under his control, the contractor shall appoint the authorised person, but if the danger to be avoided is under the control of the occupier, the occupier shall appoint the authorised person.

[Regulation 30 is left to be dealt with by the Commissioner.]

31. Every sub-station shall be substantially constructed, and shall be so arranged that no persons other than an authorised person can obtain access thereto otherwise than by the proper entrance, or can interfere with the apparatus or conductors therein from outside, and shall be provided with efficient means of ventilation and

be kept dry. (This is agreed to, subject to Mr. Sparks's clients desiring to raise any further point in their own interests.)

32. Every underground sub-station shall be under the control of an authorised person, and none but an authorised person or a person acting under his immediate supervision shall enter any part thereof where there may be danger.

33. Every underground sub-station not otherwise easily and safely accessible shall be provided with adequate means of access by a door or trap-door, with a staircase or ladder securely fixed and so placed that no live part of any switchboard or any bare conductor shall be within reach of a person thereon: Provided however that the means of access shall be by a doorway and staircase (*a*) if any person is regularly employed therein, other than for inspection and cleaning; or (*b*) in any sub-station not of ample dimensions, either if there is moving machinery therein, other than ventilating fans, or if there is extra high pressure therein.

34. Adequate periodical inspections shall be made by an authorised person to ensure that these Regulations are fully complied with.

[*** To facilitate reference, the numbering has not been altered, notwithstanding the deletion of No. 28.]

# LEGAL.

THE FRENCH ASPHALT CO., LTD., *v.* CITY OF LONDON ELECTRIC LIGHTING CO., LTD.

IN the City of London Court on Friday, plaintiffs sued defendants for £3 8s. for making good the footway paving round eight electric lighting boxes, with 1 in. of compressed asphalt and 4 in. of concrete. The secretary of the plaintiff company said that the action was one of much public importance. His company was under a contract with the City Corporation to keep in repair many of the streets of the City with asphalt, and amongst them was Fleet Street. When they re-instated the pavement recently, eight electric lighting boxes were left in a sunken condition, and the plaintiffs had to raise them under their contract with the City authorities. A grave public danger would have been caused if the work had not been done by them. They often had to do similar work for various public bodies, such as water companies, hydraulic companies, &c., and they had never known their claim to be questioned. The footways of Fleet Street were going to be relaid in sections extending over a period of four years. Defendants raised their boxes, and the asphalting now sued for was absolutely necessary. Mr. Wertheimer, counsel for the defendants, said he agreed that the case was one of great public importance, and the Postmaster-General was involved in the same way as the defendant company. The whole thing had arisen because the plaintiffs did not give defendants notice that the work was going to be done. The boxes were the defendants' by Parliamentary authority. Plaintiffs' duty was to give defendants notice before they started the work, so that defendants could have the boxes raised and tell plaintiffs how high they should be raised. Plaintiffs did their work in the night. Defendants never gave plaintiffs instructions to do the work sued for. Plaintiffs' secretary said that they would not know what levels the boxes ought to come to. It was impossible to take the same level all through the pavements. Plaintiffs were performing important public work for the defendants, and they should be paid for it. Judge Rentoul, K.C., said that the case might be one of general public importance when the facts were proved. Defendants did not seem to have ordered the work. At present he did not see how the plaintiffs could recover. There were so many legal intricacies in the matter, that plaintiffs' secretary and the directors acting with him could not deal with them. They must take legal advice, and if they decided not to go on, the defendant company would have their costs.

# BUSINESS NOTES.

**Consular Notes.**—GUADELOUPE.—The Belgian Consul at Guadeloupe, in a recent report, states that in the mountains of that country there are remarkable falls of water which could easily be utilised for producing electric energy; this is not only true of Guadeloupe, but also of the whole of the Grande Terre. It is a pity that so much motive power should be lost instead of being utilised for the establishment of an electric railway, and for lighting the towns and villages of the colony. An electric railway to unite Pointe à Pitre to Basse Terre would be of real service to the colony, and would permit of the cultivation of a great deal of land situated near this line. For many years it has been proposed to establish a railway between Pointe à Pitre and Moule, the two principal towns of the Grande Terre (about 30 kilometres), but this has not been carried into effect.

ITALY.—The British Consul at Naples, in a recent report, states that a mountain railway is proposed from Castellammare to Amalfi, to cross the spur of the Appenines which is best known as the Sorrentine Peninsula. This line will be 20 kilometres in length, and will go directly across the mountains, serving the villages of Agerola and San Lazzaro, and the rich agricultural district in which they are situated. Castellammare and Amalfi are both populous towns, but though geographically near to one another are, in fact, only accessible to each other by a journey of several hours by road and rail. The line will be electric, the motive power being largely supplied by water-power. There will be only five tunnels, of which one will be 608 metres long, and the others about 100 metres each. There will be 10 bridges of from 5 to 10 metres span. The total cost of the line is estimated in round numbers at 3,000,000 lire, including rolling stock, and the cost of the motive power would be £6 per horse-power per annum. Against this the following estimate of profits is given:—

| | |
|---|---|
| Traffic receipts ... ... ... ... ... | £12,800 |
| Traffic receipts from the Gragnano branch ... | 4,000 |
| Government subsidy, per year ... ... ... | 4,000 |
| Subsidy from towns and villages, per year ... | 184 |
| | £20,984 |

These figures give a good margin of profit, and the concessionaires are ready to place detailed plans before anyone wishing to go into the business.

COLOMBIA.—The British Minister at Bogota, referring to the machinery trade in a recent report, states that mining machinery is usually imported from the United Kingdom. Pelton wheels, which are much used, come from the U.S.A. Catalogues of machinery should state the smallest weights into which the machinery can be divided. Comparatively few places in Colombia can be reached without recourse to mule traffic, and where possible pieces should not exceed 150 lb. in weight. The amount of machinery, especially for mining purposes, which has been brought to the country and abandoned on the road would surprise anyone unacquainted with the mountainous parts of Latin America. British manufacturers are now, however, better informed respecting local conditions than was the case formerly, and it is believed in Colombia that, taking machinery as a whole, the greatest part now comes from the United Kingdom. As soon as the railways now under construction, or in contemplation, are completed, there will be a greatly increased demand for machinery of various kinds.

SPAIN.—In a recent report on the trade of Spain, the British Commercial Attaché at Madrid states that although electricity generated by hydraulic power is daily increasing as the motive power in Spain, the increase of mechanical (steam or gas) power as an auxiliary is as great or greater than was the case before electricity reached its present development. Owing to the climatic conditions of Spain, water power varies greatly in summer and winter, and until a cheap and efficient method of storing electric power can be found, there must always be a choice of evils, either of seeing a great deal of power run to waste in winter or of using that power in winter and supplementing it in summer by gas or steam. Only with streams flowing from mountains high enough to retain their snow supply throughout the summer is this not the case, the water power then sometimes actually increasing in summer. Apart from this the conditions usually attaching to concessions for electric lighting in this country impose heavy fines for failure of current for more than a short period. It is therefore essential to lighting stations to safeguard themselves by having an auxiliary mechanical plant to fall back upon when they are exposed to droughts, such as have been experienced in recent years in Spain. A competent authority has estimated that, taking Spain as a whole, there is an average of 10,000 H.P. available in nearly every province of Spain excepting Castile, of which only some 2,000 to 3,000 H.P is at present used. Whether this estimate be accurate or not, it gives an idea of the latent power which may reasonably be supposed to exist in the country. In the smaller type of steam engines British makers hold their own, but in the larger types, where economy of fuel is essential, Belgium and Switzerland have a larger share, and France and Germany also participate. Special attention has to be given to the economy of coal, a matter of great importance in Spain. In gas engines, the chief Spanish competition comes from the Maquinista Maritima y Terrestre, who have the concession for working the patents of the Lokomotiv und Maschinenfabrik Winterthur gas engines and gas-producing plant. They are supported by Catalan buyers, who appreciate the proximity of the manufacturer. Their model is a good one, and they rely on quality rather than on price for competing with rival Spanish firms, and presumably on patriotism where foreign engines are concerned. The chief competitor of British manufacturers is the German Otto engine. Gas engines attained considerable popularity in the years 1901-3; after the latter year their use declined owing, to a certain extent, to the substitution of cheap electric motors supplied with power from central stations with which the Spanish market has been flooded; but they have now again come into fashion. In many parts of Spain electric power for industrial purposes is supplied at a cheap rate, and small industries can use electric motors. Where considerable power is required the consumer would probably put up his own plant, using, in places where coal is dear, a gas plant to drive it. Spain has passed direct from the oil lamp to the electric light, and there are comparatively few gas works in the country. Where, therefore, gas engines are employed, they are generally supplied with a gas-producing plant. The best Spanish anthracite is from Penarroya, and as this produces specially dirty gas, it is necessary to have plant capable of thoroughly cleaning it. Preference for foreign machines may often be attributed to the fact that foreign works are readier in accepting the terms of payment offered by Spanish enterprise and industry for the purchase of their engines. Theoretically the usual terms are one-third with order, one-third on leaving the works or on arrival, and the remaining one-third three months later, but in practice one

would be fortunate to get normal terms of this kind, buyers liking to pay as much as possible from the profits derived from the machine purchased. The custom of long credits has been introduced within the last eight years by Continental firms, and it is now common to give one year, and sometimes up to two years. Under these circumstances, it can be readily understood that "cash with order," which is often asked by British houses, is not very acceptable in Spain. Big plants in Spain have been erected by foreign firms who financed the enterprise in many cases to the amount of their supply. There is a further reason for the increased business of foreign firms, and especially German, in steam engines, namely, the tendency in erecting electric power stations to purchase the motive power from the same country as the dynamos. British electrical machinery is practically unknown in Spain, and many foreign steam and gas engines owe their presence directly to this fact. Moreover, foreign, and especially German, engineers are far more numerous in Spain than British ones, and Germans naturally have a preference for their own machinery.

**Centralisation of Boiler Plant.**—Some time ago, Liebig's Extract of Meat Co., Ltd., acting on the advice of their consulting engineer, Mr. E. Rotter, decided to centralise their plant at the Fray Bentos factory, where some 1,800 men are employed in the manufacture of meat extracts, &c. This company has very large cattle farms in the Republics of Uruguay, Argentine and Paraguay, and every year some 200,000 head of cattle are slaughtered. To enable such a large number of carcasses to be dealt with, a very complete installation of machinery is required, and in the establishment at Fray Bentos all the machines and appliances are of the most perfect and up-to-date nature. Formerly, steam was generated by Galloway, Lancashire and water-tube boilers scattered over an area of more than 12 acres, many of the departments having separate boilers of their own. These boilers have now been done away with, and six large Stirling boilers, each of 4,000 sq. ft. heating surface, equipped with chain-grate stokers and superheaters, have been installed. Condensation of the steam in the long range of piping has been overcome by the adoption of superheat, and steam can be carried throughout the whole range of the factory without trouble from this cause. Much of the machinery has been specially designed for the company, and electrical appliances are largely employed. The whole of the piping was made to drawing, and was erected on the site without the use of any template pipes. The complete system of boilers, stokers, superheaters, piping, feed pumps, water meters, chequered floor plates, gangways, &c., was supplied by the Stirling Boiler Co., Ltd.

**Strophyte.**—A new insulating substance is being put on the market by Messrs. Rumney & Rumney, of 125, Strand, W.C., under the name given above. It is said to be fireproof, acid-proof, and non-absorbent; it can be worked in the lathe, polished, screwed, drilled and tapped. It has a low specific gravity, and can be supplied in any colour (usually black). It is claimed that Strophyte is improved by contact with grease. For its many uses and advantages we must refer readers to the agents.

**Catalogues and Lists.**—Messrs. Frederick Ryman and Co., Cox Street, St. Paul's Square, Birmingham.—Stock list (No. 8A) showing in some 16 pages illustrations, and giving prices of main switches, ceiling roses, fuse carriers, fuseboards, polished wood blocks, switch lampholders, tumbler switches, bell pushes, knife switches, &c.

Messrs. Alfred Herbert, Ltd., Coventry.—Copy of the eighth edition (J Section) of their publication describing and finely illustrating, as usual, their Hexagon turret lathe.

Messrs. Andrew & Suter, 23, Goswell Road, London, E.C.—Price list of G. A. Pestalozzi & Co.'s arc lamp carbons, for which they are sole wholesale selling agents. Another publication received from the same firm shows and describes their switchboard ammeters and voltmeters (electro-magnetic for D.C. and A.C., and moving-coil systems for D.C. only). Switchboard ohmmeters (Deprez-D'Arsonval system) for D.C. only, portable instruments and some other lines are also included, prices being stated.

From Messrs. Thermit, Ltd., of 27, Martin's Lane, E.C., we have received a copy of the first edition of *Reactions*, a quarterly magazine published by the Goldschmidt Thermit Co., of New York. It contains various articles and illustrations relating to the applications of Thermit welding.

"Electricity in Mines" is the title of a 22-page publication received from the British Thomson-Houston Co., Ltd., of Rugby. Its contents consist almost entirely of reproductions from photographs showing electrical work installed in mines for different English colliery owners.

The Electrical Co., Ltd., 121-125, Charing Cross Road, W.C.—Three new publications: No. 274, describing and illustrating the steam turbine equipment on the express steamer *Kaiser* of the Hamburg-Amerika line; No. 275, relating to "Electricity in Cotton Mills," setting forth the principles of equipment and describing a typical installation (Kearsley Spinning Co.'s new mill); and No. 277, devoted to applications of electricity in printing works, various machines with electric driving attached being shown.

The Consolidated Electrical Accessories Co., 27, Clement's Lane, London, E.C.—Twelve-page illustrated pamphlet describing and fully showing by a number of half-tone views, Pringle's patent tangential suspension for overhead conductors.

The British Electric Plant Co., Ltd., Alloa.—Thirty-six-page illustrated publication in which appears a list of all the firms for whom they have carried out contracts, these comprising electricity and gas works, shipbuilding works, steamships, engineering works, textile mills, newspaper offices, collieries and mines, and so forth. The half-tone views on alternate pages show plant suitable for such works, &c. A number of useful tables and formulæ, also some diagrams of motor connections occupy the latter half of the book.

Messrs. Simplex Conduits, Ltd., London, W.C.—A new show card of electric heaters. It is quite a novelty in show card ingenuity. Three neat designs of polished brass luminous radiators (one for wall service) are shown, also a convector radiator with matt iron case. The novelty about the card is that if a small electric lamp be lit behind the card, current is switched on to the radiators and they give a life-like ruddy glow. An advance leaflet of prices of the Simplex luminous radiators has also been received.

The Edison and Swan United Electric Light Co., Ltd., Ediswan Buildings, Queen Street, E.C.—Two new sections of their catalogue, issued separately. Section IX (part 1) shows and gives prices of a variety of bells, batteries, pushes and accessories. Part 2 of the same section sets out illustrated particulars of numerous telephones and accessories, including parlyphones, hand combination, battery wall and table, magneto, and automatic intercommunication battery telephones, also ships and mining telephones. Central station and main switchboards, and a few accessories are also detailed.

**Bankruptcy Proceedings.**—A. F. Mander, lately trading as Mander Bros., electrical engineer and cycle dealer, Victoria Road, Aston, Birmingham.—Adjudication order made March 12th on petition filed January 16th.

**Trade Announcements.**—Mr. Robert W. Paul has opened a new West End showroom at 33, Leicester Square, where samples of his various patterns of electrical instruments may be inspected. All correspondence should be addressed to Newton Avenue Works, as heretofore.

Messrs. R. Langston-Jones & Co., electrical engineers and contractors, announce that owing to increase of business they are having new premises built on a site opposite their present premises. Their address will still be High Street, Teddington.

Messrs. Estler Bros.' new address is 3, Cross Lane, Eastcheap, E.C.

The British Electric Transformer Co., Lld, of Hayes, Middlesex, announce that for the convenience of their clients in London and the provinces, they are now connected by telephone to the Ealing exchange (in the Metropolitan area), their number being: 226, Ealing (P.O.). They retain their present number on the local exchange.

Messrs. C. A. Parsons & Co., electrical engineers, have this week removed from 66 to 8, Victoria Street, Westminster, S.W. Their telephone number is unaltered.

Messrs. J. & H. Grevener, Eldon Street House, Eldon Street, London, E.C., notify that at their warehouses at the above address, they hold a large stock of flame arc lamps and accessories, and an experienced engineering staff will deal with the overhauling, repairing, and testing of lamps. They are now listing a new model intense flame arc lamp, and supplying a 4½-ampere continuous-current lamp.

Messrs. D. Santoni & Co. are carrying on business at 15-17, Beauchamp Street, Holborn, London, E.C., as electrical engineers, manufacturers, and wholesale suppliers, and they will supply the same class of goods as hitherto supplied by Messrs. D. Santoni and Co. (1906), Ltd., who have now closed down their works.

Mr. H. Bevan Swift is severing his connection with the Private Wire and Telephone Installation Co., Ltd., of Queen Street, E.C., in order to enter into business on his own account shortly, at Terminus Chambers, Holborn Viaduct.

**Book Notices.**—"Standard Handbook for Electrical Engineers." London: E. and F. N. Spon, Ltd. (New York: McGraw Publishing Co.) 1908.

"Die Elektrischen Kohlenglühfadenlampen, ihre Herstellung und Prufung." By Heinr. Weber. Hanover: Dr. Max Jänecke. 1908. Price M.9.

"An Introduction to Electricity." By B. Kolbe. Translated by J. Skellon. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1908. 10s. 6d.

"Electrical Engineers' Pocket Book." By W. H. Fowler. Manchester: Scientific Publishing Co. 1908. Prices 1s. 6d. and 2s. 6d. net.

**Storage Battery Prices in Germany.**—The firm of Gottfried Hagen, of Kalk, near Cologne, announce that in consequence of the continuing fall in the price of lead, they have made a reduction of 10 per cent. in the list prices for stationary accumulators as from March 1st.

**Rubber Planting in Tehuantepec, Mexico.**—The president of Mexican Rubber Planters' Association reports that the production of rubber shows considerable increase every year in the Isthmus of Tehuantepec. A certain amount of this product, from cultivated trees, is being exported.

**Ecuador Rubber Industry.**—The German Consul reports a large increase in the cultivation of rubber in Ecuador. Larger plantations have been started in various districts, and a great increase in production is looked for in a few years' time. The total number of trees now planted is estimated at a million. Exports of rubber in 1906 amounted to 632,569 kg., as compared with 586,556 in 1905. Prices varied between £9 and £11 per 46 kg. for "tiriado," and £13 and £15 16s. per 46 kg. for "andullo."

**Brush Hospital Fund.**—We have before us a copy of the third annual report and balance-sheet of the Hospital and Homes' Subscription Fund of the Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough. The contributions from workmen were £310, from staff £55, from directors £31, from fines £29, and these, with the balance brought forward, made a total of £513 on the income side. Donations paid out to various hospital, infirmary, nursing and convalescent institution funds amounted to £444, and a balance of £69 was carried forward.

**Trafford Park.**—We learn that one of the largest firms on this estate is offering at cost price about 50 acres of its freehold not required for extensions. This firm was one of the original buyers, and since the date of the purchase great improvements have been made at Trafford Park for facilitating all sorts of industrial operations.

**D.P. Battery Contracts.**—The D.P. Battery Co. have received an order for a battery for telegraph work from the Commonwealth Government of Australia, and a repeat order for additional cells for their battery from the Bunbury Electric Light and Power Co., of Western Australia.

**Copenhagen.**—A correspondent writes that in view of the large number of electric works, notably tramways, to be carried out within the next few years, it behoves our engineers and manufacturers not to lose sight of this market. The Government has decided to acquire and double a number of lines and to subsidise 35 lines owned by private companies.

**Reduction of Capital.** — Brush Electrical Engineering Co., Ltd., and Red.—The petition for confirming the reduction of capital from £660,000 to £489,512 is to be heard on April 4th.

**Dissolutions and Liquidations.** — Stevenson, McGuffie & Milne, consulting, mechanical, and electrical engineers, 87, Union Street Glasgow. Owing to the state of Mr. Milne's health this partnership has been dissolved from January 31st, 1908. Mr. H. A. McGuffie has assumed as a partner Mr. D. W. McGuffie, marine and mechanical engineer, and the business will be carried on under the name of Stevenson & McGuffie, at the same address.

Mica Boiler Covering Co., Ltd.—A petition for winding up this company has been presented by the Phœnix Asbestos Manufacturing Co., Ltd., of Glasgow, and will be heard in the London Courts on March 31st.

York Electrical Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator (Mr. C. A. Rymer, Yorkshire Bank Chambers, Nessgate, York) by April 11th.

London and Continental Electric Carriage Co., Ltd.—A meeting is to be held on April 23rd at South Sea House, Threadneedle Street, E.C., to hear an account of the winding up by Mr. A. E. H. Greenhow, liquidator.

Ferranti, Ltd. (old company).—A meeting is to be held on April 27th, to hear an account of the winding-up from the liquidator, Mr. J. M. Henderson.

**Fire.**—The E.L. plant at Leeswood Hall, near Mold, the property of Sir John Mark, has been destroyed by fire, the damage done being estimated at £400.

## LIGHTING and POWER NOTES.

**Aberdeen.**—The cost of the Electric Lighting Extension Act was £2,121, and it will fall to be entirely defrayed by the Corporation electricity department. The repayment of the amount may be spread over a period of five years.

**Abersychan.**—The B. of T. has revoked the Electric Lighting Order, 1903.

**Acton.**—The U.D.C. is considering the views of a deputation of local traders protesting against any increase in the charges for electricity. The Electricity Committee, having had before it the results of a reduction in charges made in October last, together with a report of the electrical engineer suggesting revision, had resolved upon the substitution of the charges first in force in the district for present rates, it being proposed to supply energy for lighting at 4d. per unit to churches and chapels, and 5d. to all other consumers, and for power at 2d. per unit. The deputation complained that it was unfair to revert to the old scale, which made electricity almost a luxury, after only six months' trial of the new charges.

**Arran.**—Acting on the instructions of the Marquis of Graham, Messrs. Stevenson & McGuffie, of Glasgow, have drawn up specifications for the supply of electric light and power at his two residences on the Isle of Arran, the estate offices, &c. A dam will be built on the side of "Goat-fell," about 700 ft. above the sea level, the water being carried to Brodick, where a power house will be built in which Pelton wheels will be installed for driving electric generators. The current will be raised to a pressure of about 3,000 volts and transmitted to sub-stations at the above-mentioned residences, &c., where it will be used for lighting and power. The transmission lines will be about 12 miles long in all; one of these will cross over the side of the mountain "Goat-fell" at a height of 1,200 ft. above the sea level.

**Ballyshannon (Co. Donegal).**—The proposed electric lighting scheme for this town has been postponed for six months.

**Boscastle.**—A private company is to be formed for the purpose of establishing electricity works in the parish.

**Bury.**—A largely attended meeting of ratepayers was held on Friday evening to consider the Corporation's proposal to extend the electricity works at a cost of from £70,000 to £100,000. It was felt that sufficient opportunity would not be given to fully consider the scheme, and it was decided to ask for a public meeting to discuss the matter before the L.G.B.'s inquiry respecting borrowing powers is held.

**Canada.**—Ottawa.—Up to the present the following municipalities have applied for power to the Hydro-Electric Commission:—Galt, for 1,200 H.P.; Berlin, for 1,500 H.P.; Hamilton, municipal plant, 1,500 H.P.; Woodstock, municipal purposes only, 900 H.P.; Preston, municipal purposes only, 600 H.P.; New Hamburg, municipal purposes only, 200.

**Coventry.**—On Tuesday the T.C. accepted a scheme for the erection of a refuse destructor, an arrangement having been entered into with the Electric Light Department to take the steam generated. The cost of the scheme, including site, was estimated at £25,956, the tender of Messrs. Heenan & Froud, amounting to £13,769, for the provision of the destructor and plant, being accepted. The plant, it was explained, would contain a three-unit system for generating steam, so that the supply could always be depended upon. The payment for the steam by the Electricity Department was to be based upon what the Department would save in coal, which was estimated at £1,000 a year. This would reduce the working expenses and sinking fund to £2,000 a year, equal to a rate of 1½d. in the £.

**Dorking.**—A L.G.B. inquiry was held last week into the application of the Urban Council to borrow a further sum of £1,160 for the purposes of electric lighting.

**Dunfermline.**—In anticipation of a plebiscite of the ratepayers on the electric lighting question, a public meeting discussed the whole subject under the chairmanship of the Provost. The Provost pointed out that to erect a generating station would cost more than to take a supply from the Fife Electrical Power Co. Bailie Husband said he was in favour of transferring the Order to the company. They had had eight reports, and although many expected that Sir Alex. Kennedy's would finish the matter, that had not been the case.

**Dublin.**—The North Dublin Guardians are considering the lighting of the union with electricity, or an improved gas system. The cost of lighting the place by electricity would be about £1,250, and the maintenance about £659 per annum.

**Durham.**—The County of Durham Electric Power Supply Co. has applied to the B. of T. for consent to the use of overhead lines for the supply of electricity in the area for the Durham, Lanchester and Chester-le-Street Rural District Councils.

**Fareham (Hants.).**—The U.D.C. is applying for a loan of £10,000 to extend its electric light works. The plans drawn up by Messrs. May & Hawes provide for the construction of a new power station in the rear of the present one, and the provision of new generating plant capable of producing 200 KW. There are to be two Diesel oil engines, each of 120 B.H.P., coupled to two dynamos, each of 80-KW. capacity, and one of 40-KW. capacity, driven by a 60-B.H.P. Diesel oil engine. The estimate for the work is £9,300, the annual charge for repayment of loan and interest being about £650. Electricity is now sold by the Council at 7d. per unit, and with the projected extensions it is anticipated that the undertaking will be even more remunerative than it has been in the past.

**Farnworth.**—The U.D.C. has entered into an agreement with the Lancs. Electric Power Company for the supply of energy in bulk, the object being to provide electricity for power purposes to large manufacturers in the district. Application has been made to the L.G.B. for sanction to borrow £7,000 for the erection of a transforming station.

**Gillingham (Kent).**—A L.G.B. inquiry was held on March 17th relative to the application of the T.C. for a loan of £5,000 for E.L. purposes. It was stated that about half the sum had already been expended.

**Hanley.**—The T.C. has resolved that the wiring of consumers' premises on the deferred payment system be charged against a special wiring account, and that thanks be awarded to the electrical engineer (Mr. C. H. Yeaman) for the manner in which he presented the case before the L.G.B. Inspector at the recent inquiry, and obtained sanction to a loan of £21,969 instead of £18,000, as had been intended.

**Haslingden.**—For some time there have been negotiations between Haslingden and Rawtenstall Councils with a view to arriving at an agreement for the latter to supply the former with electricity. Terms have been offered, and conferences between representatives of the two authorities have taken place, but a letter has just been made public in which the town clerk of Haslingden has intimated that his Committee cannot accept the terms offered by Rawtenstall, and that the Haslingden Corporation has

decided to generate its own electrical energy. The two Corporations, however, have come to an agreement for the through running of the cars between Rawtenstall and Haslingden, and also for the Rawtenstall Corporation to run cars through Haslingden to Accrington on terms.

The Bacup T.C. has been informed that a joint electrical scheme cannot be entertained.

**Heston and Isleworth.**—At the last meeting of the U.D.C. the clerk presented a long report upon the progress of the undertaking, which had been working 3½ years. For the first two years there was a profit, but last year a loss of £62; but taking an average over the three years the loss was only 11s. 10½d. He estimated that at the end of the current year there would be a profit of £237.

The District Council has decided to provide a new feeder cable for the Hounslow district, covering a distance of about 2,000 yards, at an estimated cost of £1,400. Electric light is to be installed at the Isleworth baths at a cost of £20.

**India.**—The Calcutta Mint, which is driven by steam power, is being equipped throughout with electric plant by the General Electric Co., Ltd., London.

**Lancashire Collieries.**—A mining correspondent informs us that the Earl of Ellesmere, Clifton and Kersley Coal Co., Wigan Coal and Iron Co., Ltd., Messrs. Pearson & Knowles Coal and Iron Co., Ltd., and other leading Lancashire colliery owners, are about to introduce electrical coal-cutting machines into certain of their mines.

**London.**—Stoke Newington.—On Tuesday last week the Borough Council considered resolutions passed at an informal conference of representatives of Metropolitan Borough Councils who are electric lighting undertakers, to the effect that steps should be taken to formulate a scheme for the development of the electricity supply of London by a combination of existing undertakings. It was resolved to reply that in the opinion of the Stoke Newington Council it was undesirable that a bulk supply should be provided at the risk of the rates, and that the promotion of any such scheme should be left to private enterprise, subject to proper provision being made for purchase by the local authority at a reasonable price.

Battersea.—The B.C., after taking counsel's advice, has decided to defend an action brought by Messrs. Mather & Platt, Ltd., for £800, the price of a spare armature, and to make a counter-claim. The dispute arises out of the firm's contract for the supply of generating plant.

Bermondsey.—The Electricity Committee recommended that, subject to the Finance Committee submitting the estimate of £11,170, the extension of the electricity plant be carried out, and that application be made to the L.C.C. for the amount on loan, but on the suggestion of Councillor Layman, the recommendation was deferred so that the Finance and Electricity Committees might confer on the matter.

Hackney.—On January 23rd the Borough Council adopted a scheme drawn up by the electrical engineer for providing consumers with installations for the use of energy on a hire-purchase system, and for purchase by instalments. A joint report of the Town Clerk, the borough electrical engineer, and the borough accountant was circulated this week in regard to the financial arrangements which will be necessary in connection with the scheme. With the hire-purchase system the charge to consumers is to be made up in the following manner, viz.:—Prime cost, 10 per cent. added for supervision, 6 per cent. per annum added for insurance and for maintenance, 5 per cent. per annum added for administration and interest on outstanding balances. The charge for a £10 prime cost installation under this system on the above basis will be approximately as follows:—Period of agreement, one year, four instalments of £3 2s. each; two years, eight instalments of £1 14s. 3d.; three years, 12 instalments of £1 5s.; four years, 16 instalments of £1 0s. 5d.; five years, 20 instalments of 17s. 8d. The charges under the purchase by instalment system will be made up as follows:—Prime cost, 10 per cent. added for supervision, 2½ per cent. per annum added for administration, and interest at 4 per cent. per annum on outstanding balances. The charges for a £10 prime cost installation under this system on the above basis will be approximately as follows:—One year, four instalments of £2 17s. 9d.; two years, eight instalments of £1 10s.; three years, twelve instalments of £1 0s. 9d.; four years, 16 instalments of 16s. 2d.; five years, 20 instalments of 13s. 5d.. It is expected that in the majority of cases the arrangements entered into will be for short rather than for long periods; they, therefore, suggested that for the present this branch of the undertaking be financed by the uninvested surpluses of the electricity undertaking, of which £706 is already available, and a further sum will be available soon after March 31st.

L.C.C.—At the meeting of the L.C.C. on Tuesday, the Parliamentary Committee submitted a report on the electric supply and power Bills of the present session. The Committee did not think that the Council ought to stand in the way of any Bills under which a cheap bulk supply could be obtained by private enterprise, provided that public interests were adequately safeguarded, and that existing interests were fairly dealt with. The question was whether a satisfactory solution could be found under any or all or some of the Bills promoted this session. After giving a short summary of the main provisions of the Bills, the Committee stated that it had received deputations from the promoters of the London and District Electricity Supply Bill, and the London Electric Supply Bill, and had also heard representatives from the B.C.'s. The Committee had come to the conclusion that there was no reason why the Council should depart from the view hitherto held, that the most satisfactory solution lay in a principal generating station in a favourable situation. The Committee proceeded to observe:—"We recognise that there may be advantages to be obtained under the London Electric Supply Bill if it can be so limited as not to be inconsistent with or unduly hamper a large scheme, and the same remark applies to the London (Westminster and Kensington) Bill. It must necessarily take a considerable amount of time until the new undertaking is in operation, and in the meantime, according to the contention of the promoters, it will help to cheapen electric supply if existing undertakers are allowed to make the most of their plant and stations by linking up their systems. If linking-up powers in any form are granted to the companies, we think that similar linking-up powers should also be granted to the local authorities if they are willing to take them in a Bill to be introduced next session. We do not think that the representation proposed to be given to the Council on the Joint Committee is desirable. . . . The London Electric Supply Bill also affords an opportunity for consolidating and making effective the purchase rights of local authorities over the undertakings of the existing companies, which at present are in many cases valueless, because the local authorities cannot purchase complete systems, but only such mains or stations as are within their areas. . . We proceed to deal next with the provisions of the London and District Bill for protecting public interests and safeguarding existing undertakings. In the first place, it is essential that Parliament should be satisfied as to the financial ability of the promoters, and there should be a provision that the powers are to lapse, unless a considerable proportion of the capital, say, £1,000,000, is raised within 12 months, and unless the works have been substantially commenced within two years. No objection can be taken to the maximum prices, inasmuch as these are, as pointed out above, similar to those in the Council's own Bill, but the power of asking for periodical revision of prices should also be given to the Council. We regard the purchase clause in the Bill as quite unsatisfactory. Under it the purchasing authority might have to pay large sums in respect of wholly obsolete and valueless plant, and the terms of purchase at the end of 42 years should, as in the case of the Administrative Company's Bill of 1905, be those provided by the Electric Lighting Act, 1888. There should also be a power to purchase in 1931, but in the event of purchase at the earlier date better terms would undoubtedly have to be conceded. We consider the provisions as to limitation of dividends unsatisfactory, and think that there should be substituted for it a sliding scale of prices and dividends subject to revision by the Board of Trade. With regard to the position of existing electrical undertakings, the Council is interested in this matter, inasmuch as upwards of £5,000,000 have been borrowed on the security of the rates for the purposes of such undertakings. The promoters of the London and District Electricity Supply Bill have stated that their object was to assist, and not to compete with, the existing undertakings, and to that they should be strictly held. Objections are raised both to the clause in the present Bill and also to the 'Kitson clause,' which was in the Council's Bill of last session. We hope to be able to assist in Committee in settling a clause which will be acceptable and fair to all parties. There are cases when it would appear to be clearly in the interests both of the ratepayers in the particular borough having an electric undertaking and the consumers of electric current that a supply should be taken from outside, *e.g.*, when the generating costs exceed the price at which energy could be purchased. Again, in most cases it would be more advantageous to take current from the new station rather than incur expenditure in increasing small existing stations." In conclusion, the Committee referred to the statement recently made in the House of Commons by Mr. Lloyd-George on the subject of a conference between the parties to see whether an agreement could be arrived at, and expressed the opinion that the Council should co-operate in endeavouring to secure a general agreement. The Committee recommended the Council to continue its opposition to the Bills on the lines already indicated, with a view to obtaining such amendments and the insertion of such provisions as the Committee might think necessary or desirable in the interests of the public or the Council.

**New Zealand.**—A large bush fire occurred towards the end of January in the neighbourhood of the Dunedin Council's Electricity Works at Waipori. Considerable anxiety was felt as to the safety of the plant, as the fluming is of wood, and its destruction would have stopped the water supply. As it was, some of the dwellings and a saw mill adjacent to the works were destroyed.

**Rawtenstall.**—The Corporation has just entered into contracts for generating station equipment, part of the main cables for the electric tramways, &c., involving the expenditure of £41,051.

## TRAMWAY and RAILWAY NOTES.

**Brighton.**—The Tramways Committee has granted to the Tramways Employés' Rifle Club the use of a portion of the depôt as a rifle range.

**Great Harwood.**—It was announced at a Council meeting on March 19th that representatives of the Clayton-le-Moors, Great Harwood and Rishton Urban Councils had passed the

following resolution respecting the revival of powers for the proposed Blackburn, Whalley and Padiham Light Railways:—"That this meeting is of opinion that it cannot recommend the respective Councils to oppose the application of the Blackburn, Whalley and Padiham Light Railway Co., for an order of revival and extension of time."

**Halifax.**—The Tramways Committee, in addition to a deficit of £2,841 on the year's ordinary working, estimates that it will require about £9,000 to meet compensation claims arising out of the Pye Nest accident in October last.

**London.**—L.C.C.—At the meeting on Tuesday the Highways Committee presented a report in reference to the proposed conversion to the conduit system of the tramways from Lavender Hill *via* Queen's Road to Chelsea Bridge. The length of the lines is about 1¼ mile, and the estimated cost of reconstruction is £58,013. It would only be practicable to run single-deck cars on the tramways, owing to the low headway of certain railway bridges which cross over Queen's Road. The consideration of the report was adjourned for a week.

The Council also postponed for a week a report by the Committee in respect of a projected expenditure of £76,950 for the provision of cables required for the whole of the tramway construction and reconstruction works which it is suggested should be put in hand during the financial year 1908-9. The Committee, in a further report, recommended the invitation of tenders for the supply of 175 bogie-truck double-deck cars fitted with roof covers and draught screens.

**South Shields.**—Another meeting of the T.C. was held on the 23rd inst. to continue the debate on the Tramways Committee's report, which contained a recommendation that the tramway manager be given three months' notice to terminate his engagement in the event of his not sending in his resignation. After two amendments had been defeated, the Committee's recommendation was agreed to by 26 votes to 22.

**Swindon.**—The ratepayers have now paid practically all the compensation awards arising out of the disastrous tramway car accident of June 1st, 1906. According to the *Birmingham Daily Post*, already two special rates of 1s. and one of 6d. have been paid, and a further 1d., which is included in the ensuing half-year's rates, will clear the debt. It will be remembered that four persons were killed and some 50 or 60 injured, and the compensation claims amounted to over £25,000. This is 10s. per head of the population, but the Great Western Railway Co. pays 20 per cent. of the rates of the town.

**U.S.A.**—New York.—On Sunday last an electric train left the line at a curve on the Brooklyn elevated railway, and one of the cars, containing 40 passengers, nearly fell into the street, coming to rest with the front half jutting out over the roadway. Fortunately no one was much hurt.

## TELEGRAPH and TELEPHONE NOTES.

**Cable Subsidies.**—The Civil Service Estimates for the year ending March 31st, 1909, have just been issued, and make provision under the heading of "Telegraph Subsidies and Pacific Cable" for the payment of £4,500 to the Eastern Telegraph Co.; £35,875 to the Eastern and South African Telegraph Co.; £4,000 to Eastern Extension Co.; £8,100 to the Halifax and Bermudas Cable Co.; and £8,000 to the Direct West India Cable Co., while a sum of £62,590 has been ear-marked for the Pacific Cable. After deducting appropriations in aid, there is a sum of £67,133 to be provided. The appropriations in aid are sums payable by various Colonies, such as Canada, the Australian Commonwealth, New Zealand, Mauritius and Seychelles, towards the cost and maintenance of cables.

**Cuba.**—The British Consul at Havana, in a recent report, states that a new station of wireless telegraphy at the Morro, Havana, has just been completed. A new station has also been constructed at Santa Clara, and stations are in course of construction at Camagney and Santiago de Cuba.

**Egypt.**—The Austrian Consul at Cairo, in a recent report, states that telegraphic communication in Egypt has greatly increased in recent years; the number of messages dispatched in 1906 amounted to 2,300,000, as against 2,000,000 in the previous year. The number of offices was slightly larger, but advance in this direction is hindered owing to the lack of capable operators. In addition to the Government telegraph service, there is in Egypt an English cable company which has offices in Cairo, Alexandria and Port Said, and plays an important part in the transmission of messages between Egypt and the chief European countries. Telephonic communication has also seen a considerable increase. In addition to the telephone services existing in the more important towns, there are also inter-urban services, the towns in most of the provinces being united to the large centres by telephone.

**Ethiopia.**—The Belgian Consul at Adis Abeba, in a recent report, states that Adis Abeba is joined to Harrar and Diré Douah by a telephone line which is open to the public. A second line, belonging to the Emperor, joins Adis Abeba to Limmon, Djimmah, Kaffa and Koullon. A third is under construction between Adis Abeba and Ouallamo *via* Kambata, and it will eventually be extended to Sidamo. A fourth line exists between Adis Abeba and Gondo *via* Ankoker and Wollo. Towards the north, Italy has constructed a telegraph line from Adis Abeba to Asmara and Massouah worked by Italians, and Cairo is in telegraphic communication with Abyssiania, *via* Wadi Halfa, Kassala and Asmara. Telegrams to Belgium are subject to a charge of 2·8 fr. per word *via* Massouah, the rate *via* Djibouti being dearer, viz., 4 fr. per word.

**St. Lucia.**—The Administrator of St. Lucia, in a recent report on the trade of that island in 1906-7, states that the telephone system of the colony consists of 112½ miles of trunk line, and 54¾ miles of branch line, or a total of 167¼ miles. The lines were maintained in good working order throughout the year, and a sum of £219 was expended in reconstruction and improvements. On December 31st, 1906, there 110 subscribers, as compared with 111 in 1905. The receipts were £565, being £14 more than in 1905 and the expenditure £1,073, or £508 in excess of the revenue. The expenditure included £500 paid for the purchase of the military telephone system and stores, which were taken over by the Government on the removal of the troops.

**South Africa.**—Telephonic communication has been experimentally established between Graham's Town and Port Elizabeth.

**Telephone Rates.**—The Postmaster-General has been in communication with the French Government concerning the establishment of new telephone circuits, and as soon as these are in operation a substantial reduction in rates will be made.

**Telephone Secrets.**—Three British engineers employed in an Antwerp telephone factory have been arrested on a charge of having divulged to a competing British firm various secret improvements that had been introduced in the manufacture. Further arrests are expected.

**The World's Telegraphs.**—The Bureau International des Administrations Télégraphiques has issued its report for the 39th year, viz., 1907. In accordance with the resolution adopted by the Berlin Wireless Telegraph Conference of 1906, the Bureau organised a department to deal with this branch of the service, and it was fully working on January 1st, 1907. The following countries are now adherents of the St. Petersburg Convention, viz., Germany, Argentina, Australian Commonwealth, Austria, Belgium, Bolivia, Bosnia-Herzegovina, Brazil, Bulgaria, Cape of Good Hope, Ceylon, Portuguese Colonies, Crete, Denmark, Egypt, Spain, France and Algeria, Great Britain, Greece, Hungary, British Indies, Dutch Indies, French Indo-China, Iceland, Italy, Japan, Luxemburg, Madagascar, Montenegro, Natal, Norway, New Caledonia, New Zealand, Orange River Colony, Holland, Persia, Portugal, Roumania, Russia, Senegal, Servia, Siam, Sweden, Switzerland, Transvaal, Tunis, and Uruguay. The total area of all these countries is 65,895,439 sq. kilometres, with a population of 945,413,154.

Of the various telegraph companies, 19 are adherents, 15 conform to regulations although non-adherents, and five correspond with the Bureau through the medium of other companies. In the first group are included the Black Sea, Commercial, German Atlantic, East European, French, German-Dutch, Rio de la Plata, Direct Spanish, Direct West India, Eastern, Eastern Extension, Great Northern, Halifax and Bermudas, Indo-European, South American, Spanish National, West African, West India and Panama, and Western Telegraph and Cable Companies. The second group comprises the African Direct, Amazon Western Union, Anglo, Central and South American, Commercial Pacific, Cuba Submarine, Direct United States, Eastern and South African, Europe and Azores, India-Rubber, Gutta-Percha and Telegraph Works, Mexican, Pacific and European, River Plate and West Coast of America Telegraph and Cable Companies. The third group consists of the African Trans-Continental, British North Borneo, Commercial (Cuba), Postal and United States and Hayti Telegraph and Cable Companies. After enumerating the various cables laid and telegraph lines constructed, the report states that during the past year 5,200 new offices were opened to International traffic.

The Bureau had estimated their receipts for 1907 at £6,501 and expenses at £2,580, whereas they amounted to £5,663 and £2,511 respectively, leaving a sum of £769 in favour of the administration. The estimated receipts and expenditure for 1908 are also given, which, in view of the Telegraph Conference to be held at Lisbon on May 4th, are higher than in 1907.

### Telegraphic Interruptions and Repairs:—

| Cables. | | Interrupted. | Repaired. |
|---|---|---|---|
| Curacao-Coro<br>Curacao-La Guayra<br>Curacao-Maracaibo | Closed.. .. .. | .. Jan. 12, 1906 .. | .. |
| Tarifa-Tangier .. .. .. .. | | .. Jan. 18, 1904 .. | .. |
| Port Arthur-Chifu (Closed) .. .. .. | | .. Mar. 9, 1904 .. | .. |
| Alexandra-Larnaca .. .. .. .. | | .. Jan. 28, 1908 .. | .. |
| Paramaribo-Cayenne .. .. .. .. | | .. Mar. 15, 1908 .. | .. |
| **Landlines.** | | | |
| Puerto-Barrios .. .. .. .. .. | | .. Aug. 2, 1902 .. | .. |

**Wireless Telegraphy.**—It is reported that the Hamburg-South American steamer *Kap Arcona*, on the occasion of her last homeward journey, was able to exchange wireless messages with the coast station at Scheveningen, Holland, the distance being 868 miles. It had previously been possible for several other vessels belonging to the same company to communicate with each other at distances of 312 miles at first and 700 miles subsequently.

Bluejackets were recently engaged in fixing wireless telegraph apparatus to the dome of the new Admiralty Buildings, so that in the event of the interruption of the landlines the Admiralty may be able to communicate with naval ports and the Fleet in the North Sea and Channel.

The Ottoman Government is taking steps to develop communication by means of wireless telegraphy in the Arabian Peninsula, especially in the Provinces of Hedjaz and Yemen.

A wireless telegraph station is to be installed at Easington, near the Humber mouth, by the Admiralty.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—Tasmania.—May 11th. The Postmaster-General at Hobart requires tenders for 200 wall telephones, 800 telephone recorders and cords, and material for common battery and switchboard extensions. Particulars at the G.P.O.

Melbourne.—April 7th. 30½ miles bare hard-drawn copper cables for the City Council. See "Official Notices" March 20th.

April 14th.—Two cables between Victoria and Tasmania. See "Official Notices" February 21st. Copy of form of tender may be seen at the Electrical Review office.

**Austria.**—The municipal authorities of Gratz are about to invite tenders for the establishment of a central electric lighting station in the town.

**Belgium.**—April 6th. The municipality of Saventhem is inviting tenders for central station extensions which were referred to here last week.

Brussels.—April 7th. The Société Nationale des Chemins de fer Vicinaux, 14, Rue de La Science, requires tenders for 1,630 tubular standards for overhead traction equipment. Particulars may be obtained from the Secretary by sending 10d. to above address.

Brussels.—April 15th. Tenders are required by the Belgian Government Railways Department for an electric signalling cabin, to which reference was made here last week.

**Bourges.**—April 24th. The Central Pyrotechnic School invite tenders for an electric crane. Secrétaire de l'Ecole Centrale de Pyrotechnic, Bourges (departement du Cher).

**Bloemfontein.**—April 7th. A motor-generator and switchboard are wanted for the railway workshops. Transvaal Government Agent, 72, Victoria Street, Westminster, S.W.

**Bray.**—April 7th. Supplies for the U.D.C.'s electricity department. See "Official Notices" March 13th.

**Bristol.**—April 7th. Stores for the Electricity Department. See "Official Notices" March 20th.

**Cape Town.**—April 15th. City Council invites tenders for three-core cable and service joint-boxes. Particulars, City Electrical Engineer, Dock Road, Cape Town.

**Copenhagen.**—March 31st. The Commercial Intelligence Branch of the Board of Trade have received from His Majesty's Consul at Copenhagen copies of the conditions and specification relating to a call for tenders for the supply of cables for electric lighting purposes. Tenders to be marked "Tilbud paa Vekselstromskabeler," and addressed Direktoren for Kobenhavns Belysningsvaesen, Copenhagen. The conditions and specification may be consulted by British makers on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Czernowitz.**—April 21st. A waterworks station worked by electricity and lighted by electric incandescent lamps. See last week's Electrical Review.

**Dewsbury.**—March 30th. Surface condenser and cooling tower for the Electricity Committee. See "Official Notices" March 6th.

**Dundee.**—The electricity department invite tenders for general stores.

**Edinburgh.**—March 30th. Materials for the Electricity Supply Department. See "Official Notices" March 13th.

**Edinburgh.**—March 30th. The Midlothian and Peebles District Asylum Board at Rosslynlee requires tenders for supply, from April 15th to October 14th, of electric fittings and engine-room stores. R. Addison Smith, clerk and treasurer, 19, Heriot Row.

**Edinburgh.**—April 1st. Wiring and fitting of public washhouse, Simon Square. Frank A. Newington, engineer electricity supply station, Dewar Place.

**Falkirk.**—Tenders are to be invited by the Council from the original makers, and several other firms, for battery plates. The engineer is also to invite offers for an automatic booster.

**Glasgow.**—April 6th. Various works in connection with the erection of Hogg's Road sub-station. Ten schedules, £2 2s. each. W. W. Lackie, electrical engineer, 75, Waterloo Place.

**Glasgow.**—April 6th. Stores for the Corporation Tramway Department. Purchasing department, 46, Bath Street.

**Huddersfield.**—March 31st. Tramway stores for the Corporation. J. Henry Field, Town Clerk.

**Lancs. & Yorks. Railway.**—March 30th. Telegraph and electric light wires for one year. Mr. Waring, Stores Department, L. & Y. Railway, Osborne Street, Manchester.

**Leeds.**—March 31st. Coal and stores for the E.L. Department. See "Official Notices" March 13th.

**Leek.**—April 11th. Gas producer plant and one gas-driven generator for the U.D.C. See "Official Notices" March 20th.

**Limerick.**—April 10th. Stores for the electricity department. See "Official Notices" to-day.

**London.**—April 15th. E.L. installation at the S.W. Hospital, &c., for the Metropolitan Asylums Board. See "Official Notices" to-day.

**Partick.**—April 4th. Stores for the Electricity Department up to May, 1909, not 1908, as stated in our "Official Notices" March 20th.

**Poplar.**—April 29th. Switchboards and gear for electricity works and sub-stations of the Council. See "Official Notices" to-day.

**Salford.**—March 30th. Stores for the Electricity Department. See "Official Notices" March 20th.

**Spain.**—Madrid.—April 10th. 160 tons of galvanised iron or steel wire 4 mm. in diameter, 40 tons of bronze wire 3 mm. in diameter, and 2 tons of bronze wire 2 mm. in diameter. Tenders to the office of the Chief of the Sección de Telégrafos, sito Carretas, 10, Madrid. A deposit of 5 per cent. to qualify any tender.

Madrid.—April 11th. "Dirección general de Correos y Telégrafos," 100,000 porcelain insulators. Tenders to Chief of the Sección de Telégrafos, sito Carretas, 10, Madrid. Deposit, 5 per cent. of the total amount. Some information concerning conditions of contract for the above tenders may be consulted at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. British local representation is necessary.

**South Shields.**—April 11th. Stores for the tramways department. See "Official Notices" to-day.

**Sunderland.**—April 9th. Stores for the Corporation's Tramway Department. See "Official Notices" March 20th.

**Sunderland.**—Bitumen-insulated cables for workhouse. W. & T. R. Milburn, architects, 20, Fawcett Street, Sunderland.

**Valparaiso.**—May 30th. The Junta Economica de la Direccion del Material of the Navy Department requires tenders for the equipment of the Chilian Navy with electrical instruments, motors, and fittings. Five years contract.

**Wallasey.**—April 15th. Circuit-breakers for the U.D.C. See "Official Notices" to-day.

**Wallasey.**—April 15th.—Stores for the electricity department. See "Official Notices" to-day.

**Weymouth and Melcombe Regis.**—April 18th. 300-kw. steam turbine and d.c. generator, surface condensing plant, pipework extension switchboard panel, for the Corporation. See "Official Notices" to-day.

### CLOSED.

**Australia.**—Postmaster-General's Department. Five additional subscribers' sections, and one junction line section and extensions, &c., in connection with the common battery switchboard at the Central Telephone Exchange, £9,809; also certain additional apparatus. R. B. Hungerford.

**Brisbane.**—Postmaster-General's Department. Eight hundred and eighty yards of lead-covered cable, 208 pair, 12½ lb. conductor, £630 per mile; 2,860 yards ditto, 104 pair, 12½ lb. conductor, £360 per mile; 320 yards ditto, 78 pair, 20 lb. conductor, £380 per mile; 3,941 yards ditto, 52 pair, 20 lb. conductor, £285 per mile; 140 yards ditto, 39 pair, 20 lb. conductor, £245 per mile; 880 yards ditto, 26 pair, 20 lb. conductor, £180 per mile; 440 yards ditto, 13 pair, 20 lb. conductor, £115 per mile; 880 yards ditto, 2 pair, 20 lb. conductor, £25 per mile.

W. T. Henley's Telegraph Works Co., 4,000 insulators, 3d. each.; F. Wicker, Tool & Co., 2,000 black iron Y spindles, 2s. 1½d. each; 10 cwt. of soft drawn copper wire (50 lb. per mile), A. Sergeant & Co.

**Bristol Docks.**—The Docks Committee has placed an order with Messrs. Johnson & Phillips, Ltd., for a complete installation of cable, switchgear, arc lamps, &c., for Avonmouth Dock.

**Croydon.**—The Board of Guardians has accepted the tender of Messrs. Pryke & Palmer for the supply of electrical fittings and appliances.

**Heston and Isleworth.**—The District Council has accepted the following tenders for annual supplies for the electricity department:—

W. T. Henley's Telegraph Works Co.—Cables, disconnecting and house service boxes, and compound.
British Insulated and Helsby Cables, Ltd.—House fuse boxes.
A. Duckham & Co., and Middleton Bros.—Engine oil.
Geipel & Lange.—Carbons, £3 7s. 6d. per 1,000.
Leeds Contract Co.—Earthenware troughs (square), £1 6s. 6d. per 100; earthenware troughs (U shaped), £1 per 100; hard burnt tiles (various sizes), £2 0s. 6d., £3 4s. 6d., £2 5s. 9d., and £1 8s. per 1,000.

**Hornsey.**—The contract for installing electric light at Highgate sanitary depôt has been placed by the Hornsey B.C. with Mr. F. V. Slatter.

**Hucknall Colliery.**—An order has been placed with Messrs. Johnson & Phillips, Ltd., for the supply and erection of a three-phase H.T. overhead transmission line.

**London.**—The Highways Committee of the L.C.C. purposes to extend existing contracts with the Frodingham Iron and Steel Co. for slot and conductor rails, and with the Hadfield's Steel Foundry Co. for special trackwork, so as to provide for the delivery of these materials for the reconstruction of the Queen's Road (Battersea) tramways. The cost for special work is estimated at £5,283, and that for the slot, &c., rails, at £2,633.

Islington.—The Board of Guardians has accepted the tender of Pryke & Palmer for the annual supply of electrical fittings and sundries.

The B.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for boilers for the electricity works extension, at £10,694, and that of Messrs. Willans & Robinson for turbo-alternator, at £8,968. Tenders for coal, at prices ranging from 11s. 4d. to 12s. 4d. per ton, were also accepted.

**Manchester.**—The Corporation has placed an order with Messrs. Johnson & Phillips, Ltd., for three-phase transformers for one of its sub-stations.

## CONTRACTORS' COLUMN.

### Openings for New Business.

ABBEY HILL (Wicklow).—Rebuilding premises for S. Delahunt. G. T Moore, architect, 1 and 2, Foster Place, Dublin.

ABERBARGOED.—New school (accom. 400) near the English Congregational Church.

ABERDARON (near Pwllheli).—Residence for Capt. R. Griffith, Penybryn, Uwchymynydd. R. L. Jones, architect, 86, High Street, Pwllheli.

ABERDEEN.—Additions to premises in Fraser Road for Edgar & Crerar, bedding manufacturers. W. E. Gauld, architect.

Two houses in Devanha Gardens (South) for T. Wood & P. Lees, fish curers. D. & J. R. M'Millan, architects.

House in Balnagack Road for Freeland Bros., fish merchants. D. Hodge, architect.

Pavilion in University Road for the Aberdeen University Court. A. M. Mackenzie & Son, architects.

ADLINGTON.—Council school. Lancs. County Education Authority.

APPLEDORE (Devon).—Additions to the Royal Hotel for Arnold & Co., brewers, Barnstaple. Mr. Southcombe, architect, Barnstaple.

ASCOT.—Additions to Royal Victoria Nursing Home, South Ascot; and residence for Mr. Round.

ASHTON-UNDER-LYNE.—Extensions to Boodle Street works for J. Heap and Co., Ltd., toolmakers.

BARNSLEY.—Houses, Sherwood and Bala Streets, for C. W. Plastow; Derby Street, for E. Pashley; Blenheim Grove for C. Woodruff.

Alterations and additions to residence in Dodworth Road. E. W. Dyson, architect, 10, Regent Street, Barnsley.

(Darton).—Nurses' House at Perkin Hill, for Mrs. Fountain.

BEXHILL.—Bungalow, Collington Lane. Miss Stewart, owner; G. E. Maynard, architect.

House, Collington Avenue. G. E. Maynard, owner and architect.

Detached residence, Sutherland Avenue. W. White owner; A. A. Oakden, architect.

Addition to Manor House. Countess De La Warr, owner; G. H Gray, architect.

Four semi-detached villas, Dorset Road. Moon & Garner, owners G. H. Gray, architect.

BERWICK.—Renovation an provement of Castlegate Baptist Church. Rev. J. L. Harvey.

BILSTON.—New Roman Catholic school. J. P. Baker, architect, Market Place, Willenhall, Staffs.

BELFAST.—Contemplated completion of the Lunatic Asylum Colony (£35,000).

BIRMINGHAM.—Pumping station for the Birmingham, Tame and Rea District Drainage Board. J. D. Watson, engineer to the Board, Tyburn, near Birmingham.

School in Little Green Lane for mentally and physically defective children. Birmingham Education Committee.

Proposed public hall for Northfield, adjoining Station Hotel (seat 600).

(Solihull).—Six houses, Streetsbrook Road, for J. W. Blackham; two houses, Lyndon Road, for Mr. Ward; two houses, Beech Lane, for Mr. Lines; two houses, Warwick Road, for Mr. Warriner.

BLACKFORD (Perthshire).—Additions and alterations to Orchill mansion house. D. Campbell, builder, Blackford.

BLACKTOFT.—Council school for 82 children and teachers' house, for the E. Riding of Yorks Educational Committee. Building surveyor, County Hall, Beverley.

BOLTON.—Extensions at Mortfield Bleach Works. T. Cross & Co., Ltd.

BOURNEMOUTH.—Church house and institute in connection with St. Michael's, Poole Road (£3,070). J. Oldrid Scott & Son, architects, 2, Dean's Yard, Westminster, S.W.; Baker and Pearcy, builders, Parkstone, Dorset.

Homes of Rest at West Howe for W. H. Saunders. Trevanon, Curtis and Ridley, solicitors, Bournemouth.

BOYNTON.—Council school for 50 children for the E. Riding of Yorks Education Committee. Building surveyor, County Hall, Beverley.

BRAEMAR (Aberdeenshire).—Fife Arms Hotel extensions. Kelly & Nicoll, architects, Aberdeen.

BRANDON (Suffolk).—Rebuilding old concert hall on enlarged plan by A. Paget, Brandon Park.

BRECHIN.—Private consumptive sanatorium near junction of Old Dundee Montrose and Forfar Roads, for Miss Lowson, Balgavie.

BRECONSHIRE.—Schoolrooms and classrooms in connection with Llangammarch Wells Church.

BRENTWOOD (Essex).—Alterations and additions to the Grammar School.

BRIDGWATER.—Bandstand in Park. F. Parr, borough surveyor.

BRIGHTON.—Golf Club House at the Municipal Golf Links, Hollingbury Park (£400). Borough Surveyor.

BRIGHTSIDE and CARBROOK (Sheffield).—Laundry at Shiregreen, for the local Co-operative Society.

BROMLEY.—Houses, Langdon Road, for H. R. Latter; Elmstead Lane, for Trehearne & Norman; Edward Road, for C. H. B. Quennell; Park Avenue, for E. Pawley; Gilbert Road, for the Kinnaird Park Estate Co. and W. J. Harrington.

Two houses, Langdon Road. H. R. Latter, architect.

Additions to "Albyfield," Blackbrook Land. F. P. Duboit, architect.

Business premises, Widmore Road. P. Coad, architect, 101, Mason's Hill, Bromley.

BRYNCOCH (near Neath, Glam.).—Elementary School. W. E. R. Allen, deputy clerk, Glamorgan County Council, Cardiff.

BRYNMAWR (Mon.).—Business premises in Beaufort Street. J. Watkins, 17, Worcester Street, Brynmawr.

BUGLE (Cornwall).—New Institute. Warne Bros., builders.

BULLOUGH MOOR (Heywood).—Proposed Council School (750 scholars). Heywood Education Committee.

BURNHAM (Somerset).—Houses, for T. F. Huish, Mr. Pitts and Mr. Pople.

BURY.—Proposed Municipal Secondary School off Manchester Road, Fishpool. Local Education Committee.

Extensions to works at Elton. C. Walmsley & Co., engineers and ironfounders.

CAMBRIDGE.—Mission Room and Cottage, Romsey Terrace, for Mrs. Lewis and Mrs. Gibson, Castle Brae, Chesterton Lane.

CANTERBURY.—Residence in Queen's Avenue, St. Dunstan's. J. Edwards, builder, Hanover Road, Canterbury.

Repair and redecoration of County Hotel, High Street, after fire F. T. Gentry, builder, Canterbury.

CARSHALTON.—Houses, Byron Avenue for Faulkner & Sons.

CHAPEL-EN-LE-FRITH (Derbyshire).—Sewerage scheme (£23,000). Messrs. Swan & Brady, Chapel-en-le-Frith.

CHARD.—Council Schools. W. J. Willcox, architect, Bath.

CHEADLE.—Council school (£9,000).

CHEAM (Surrey).—Shops in Gander Green Lane, for J. Hole.

CHESTER.—Proposed new school for parishes of Hoole and Newton, near Chester. Cheshire County Education Committee.

CHICHESTER.—Council schools for the Joint Education Committee.

CHIPPENHAM.—Villa residences, Ladyfield Estate, for Mr. Rogers.

Additions to Willow House, Biddestone, for Sir John Dickson Poynder.

CHIPSTEAD (Surrey).—Residence for W. Garland Till, Wallington.

CLEATOR MOOR (Cumberland).—Catholic Hall (£2,000).

CLECKHEATON.—Additions to Chemical Works, Moorend, for the Killgerm Co., Ltd.

CLIFTON JUNCTION (near Manchester).—Projected new wagon works for L. & N.W. Railway Co.

CLOWNE (near Chesterfield).—Houses, Neale Street, for Mrs. Lilley; North Road, for F. J. Hutchings; Creswell, for Mr. Lawley; Spinkhill, for J. P. Marsh.

COATBRIDGE (N.B.).—Church and halls for Crichton Street Church. Rev. W. Miller, minister.

COLNE VALLEY.—Co-operative Fakeries for Colne Valley Bakery, Ltd.

COUNDON (near Bishop Auckland).—Primitive Methodist Sunday School. Mr. Tallentire, architect, 19, Osborne Terrace, Leeholme, Coundon.

Minister's house for the Shildon Primitive Methodist trustees. J. Walton Taylor, architect, St. John Street, Grainger Street West, Newcastle.

CUMBERWORTH (Huddersfield).—Primitive Methodist Schools at Lower Cumberworth.

CUPAR.—Extensions for J. Wishart, fancy goods merchant. H. A. Newman, architect, Cupar.

Extension of office of Inspector of Weights and Measures. Mr. Henry, architect, St. Andrews.

CWMAVON (Glam.).—Schools for the Glamorgan Education Committee (£13,784). Waring, Cole & Waring, builders.

DARLASTON (Wednesbury).—Primitive Methodist Church at King's Hill.

DARTON.—Proposed institute in School Street connected with Darton Young Men's Mutual Improvement Society.

DERBY.—Roman Catholic School in Cromwell Road. A. Eaton, architect, Derby. R. Weston & Son, builders.

DINAS POWIS (near Cardiff).—Elementary school. W. E. R. Allen.

DOUGLAS (I.O.M.).—New hospital on Hill's Estate for the Governors of the Isle of Man Hospital (£20,000).

DUNDEE.—Alterations to 1, Bernard Street, for J. Knight.
Villas in Blackness Road for J. G. Gilchrist.
Alterations to property for the trustees of the late D. Pirie.
Workshops in East Henderson's Wynd for M'Culloch & Jamieson.
Motor garage and outhouses in Hazel Hall Drive for H. T. Walker.
Alteration to 176, Lochee Road, for A. S. Cameron.
Alterations to 65, Murraygate, for Mather's Trustees.
Motor house in Farrington Street for J. Watson.
Alteration to property in Union Place for Halket & Adam.
Alteration to 77, Victoria Road, for Miss J. Spiller.
Diphtheria wards at King's Cross Hospital (£4,000).

EASTBOURNE.—Proposed enlargement of the Princess Alice Hospital. Hon. Secretary, Princess Alice Hospital, Claremont Chambers, Eastbourne.

ECCLES.—E.L. installation in Clarendon Road Schools for the T.C. Education Committee.

ELLSMERE PORT (Cheshire).—Council schools (£7,000). C. E. Deacon, (Deacon and Horsburgh), architect, 41, North John Street, Liverpool.

EMSWORTH.—New school. Managers of Chidham School, near Emsworth.

EPSOM.—Bungalow on Epsom Downs Estate, for Mr. Samson.

ESHER.—Extension to Royal Mills.

EXETER.—Eight houses, Athelston Road, The Barnfield. J. A. Lucas architect, Exeter.
Alterations and additions to "The Hawthorns," Silverton. J. A Lucas, architect, Guildhall Chambers, Exeter.

FELIXSTOWE.—New pavilion for the U.D.C. H. Clegg, engineer, Town Hall, Felixstowe.

FERRYHILL (Co. Durham).—Alterations and additions to the Commercial Hotel, for Mr. Richardson.

FILEY.—Masonic Temple for the Royal Lodge (No. 643).

FLEETWOOD.—Houses, Poulton Road, for T. Halsall; Dronsfield Road, for J. Butler; Oak Street, for Mr. Whittaker.

FYLDE (Lancs.).—Two houses at Dowbridge, Newton, for T. B. Tomlinson; alterations and additions to Burgh Castle, Carleton, for Mr. John Fecitt.

GALASHIELS.—Proposed conversion of Ladhope Vale Technical Schools into Social Institute.

GALWAY.—Improvements to Harbour (£60,000).

GLAMORGANSHIRE.—New schools at Blaengwynff, Aber (Ogmore Valley), Bedlinog, Port Talbot, and Heolyciw, for the C.C.

GOLCAR (Yorks).—Twenty-four houses at Scarhouse, for the Co-operative Society. Lunn and Kaye, architects, Milnsbridge, Huddersfield.

GORSEINON (Glam.).—Galvanising works for the Bryngwyn Steel Co., Ltd. Rees & Kirby, Ltd., contractors, Morriston, Swansea.

GREAT CROSBY (near Liverpool).—Public elementary school. H. Littler, architect, 16, Ribblesdale Place, Preston.

HARROGATE.—Motor garage at the Queen Hotel for the Queen Hotel Co.
Houses, Hereford Road, for D. Simpson; Rawson Street, Bilton, for Brown & Stables.
Billiard room at Birk Lea, Trinity Road, for J. Lowden.

HARWICH (Dovercourt).—Secondary school (£6,423). Brown & Burgess, architects, 5, Arcade Street, Ipswich.

HASLINGDEN.—Contemplated sewerage developments (£1,800). Corporation.

HASTINGS.—Drill Hall, Bexhill Road, for Viscount Curzon.

HELMSHORE (Haslingden).—Public school (£5,370). Haslingden Education Committee.

HENDON (Sunderland).—New Free Library. Architects, Davidson and Cratney, 70, Station Road, Wallsend-on-Tyne; builder, Jos. Huntley, Marion Street, Sunderland.

HERNE BAY.—Houses, Hillborough Road (R. Messenger, architect, High Street, Herne Bay); Reculver Road, for Mrs. Spratt.

HEXHAM.—Primitive Methodist Church and School (£6,000).

HIGHWORTH (Wilts.).—Renovation of buildings and new class rooms in connection with Highworth Congregational Church. Rev. A. Ore.

HIGH WYCOMBE.—New chair factory, Kitchener Road, for H. T. Dickens.
Engineering works, London Road, for J. F. Bateman.

HITCHIN.—Additions to residence "The Hoo," for Mr. Heatley. C. M'Crickner, architect, Lincoln's Inn Fields, London.
Houses, Old Park Road, for F. Street (C. F. Sherren, architect).

HORBURY (Yorks).—School buildings in connection with St. Mary's Church, Horbury Junction (£1,000).

HORLEY (Surrey).—Houses, Hookwood, for Michael Covey, builder, Horley; and Lumley Road, for Mrs. Giles.

HORSHAM.—Enlargement of the Cottage Hospital. G. E. Porter, hon. secretary, The Cedars, North Parade, Horsham.

HOUNSLOW.—Flats. T. Hiscock, 181, High Street, Hounslow, builder.

HUDDERSFIELD.—Manager's residence and workmen's houses at the Corporation sewage works, Deighton. K. F. Campbell, borough engineer, 1, Peel Street, Huddersfield.
(Lockwood).—Five houses and shops in Victoria and Fenton Roads. J. B. Abbey & Son, architects, New Street, Huddersfield.

HUNTLY.—Shops and chambers, Duke Street, for J. R. McMath. T. G. Archibald, architect, 27, Duke Street, Huntly.

KIDDERMINSTER.—Mission Church at Broadwaters.
Store room at the Workhouse.

KIRKWALL.—Enlargement of Head Post Office. Postmaster, Kirkwall, or H.M. Office of Works, Edinburgh.

LEEDS.—Alterations at the City Education Offices, including provision of a lift (£1,200).
(Pateley Bridge).—New Wesleyan Church. W. Morley & Sons, architects, 269, Swan Arcade, Bradford.

LEEK.—Extension to generating station for the U.D.C. W. E. Beachan, Council surveyor, Town Hall, Leek.

LEITH.—Six villas near St. Serf's Church, Ferry Road. Hay & Ogilvie, builders.

LENZIE (N.B.).—Enlargement of the Academy (£3,000). Chairman, Lenzie Combination Board.

LINTHWAITE (Yorks).—Houses, Smithriding, for W. Hayes; and shop, Smithriding, for W. S. Heppenstall.

LLANDAFF.—Elementary school. W. E. R. Allan.

LLANDRINDOD WELLS.—New General Post Office.

LLANELLY.—Rebuilding Hope and Anchor Hotel, Queen Victoria Road, for Mrs. M. Howell. J. Billet, architect, 33, Prospect Place, Llanelly.
Houses (10) Prospect Place. W. Griffiths, architect, Llanelly.

LLANTRISSANT.—Elementary School. W. E. R. Allen, deputy clerk, Glamorgan County Council, Cardiff.

LONDON (S.W.).—Proposed army recruiting station in Great Scotland Yard (£25,000).
(South Bermondsey).—Schoolrooms and Lecture Hall in connection with Ilderton Road Sunday School (accommodate 1,400).

LONDON (Ealing, W.).—University College Hall for the University College Hall, Ltd.
(East Ham, E.).—Extension to the Isolation Hospital. A. H. Campbell, borough engineer, Town Hall.
(Hackney, N.E.).—Two shops in Mare Street. Owner, 1, Victoria Park Road, N.E.
(Woolwich).—Railway station in Westmount Road, Well Hall.
(Anerley, S.E.).—Congregational Church on Royston's Estate, Penge.
(Catford, S.E.).—Shop. J. W. Falkner & Sons, builder, 24, Ossory Road, S.E.
(Balham, S.W.).—Development of estate between Upper Tooting Road, and Glanburnie Road. W. C. Poole, architect, Belle Ville Road, Wandsworth Common, S.W.
(Croydon).—Six houses. Dartnell & Banks, architects, 34, High Street, Croydon.
(Battersea).—Extension of mains to supply current to A. Stagg, 75, Winsham Grove.
(Kensington High Street).—Rebuilding premises. C. F. Kearley, builder, 4, Great Marlborough Street, W.
(Croydon).—Development of Brickwood Estate. W. J. Blake, 45, High Street, Croydon.
(Clapton Common, N.E.).—Eight houses. W. M. Dabbs & Son, builders, 19a, Goulton Road, Lower Clapton.
(Tower Bridge, S.E.)—Buildings. Barlow & Roberts, 15, Red Cross Street, S.E.
(Tidal Basin, E.).—Iron shed at Alexandra Wharf. Baldwins, Ltd., 5, Fenchurch Street, E.C.
(Piccadilly, W.).—Alterations to Berkeley Restaurant. J. Simpson and Son, builders, 48, Paddington Street, W.
(St. Pancras).—Operating room at workhouse infirmary. A. E. Pridmore, architect, Broad Street Buildings, E.C.
(Kensington High Street).—Buildings on sites of Nos. 173, 189, 191, 193, 195. Higgs & Hill, builders, Station Works, Hinton Road, Herne Hill, S.E.
(Peckham, S.E.).—Buildings for G. G. Bussey & Co., Ltd., 133, Rye Lane.
(Deptford).—Fifteen houses in Revelon Road. F. J. Oldham and Sons, builders, 91, St. Asaph Road, S.E.
(Deptford).—Additions to business premises, 209, High Street, for C. Pfisterer.
(Dollis Hill, N.W.).—Mission Hall. Rev. G. H. Ayerst.
(Strand, W.C.).—Permanent additions to Law Courts. H.M. Office of Works, Storey's Gate, S.W.
(Trafalgar Square, W.C.).—Extension of National Gallery (£58,500). H.M. Office of Works, Storey's Gate, S.W.
(W.C.).—Addition to Patent Office (£90,000). H.M. Office of Works, Storey's Gate, S.W.
(Lewisham, S.E.).—Eleven shops and stables, Muirkirk Road. Norfolk & Prior, architects, Catford, S.E.
(Lewisham, S.E.).—Fourteen houses, Bankwell Road. Hatch and Hatch, agents, 2, Catford Hill, S.E.
(South Kensington, S.W.).—Meteorological office (£10,500). H.M. Office of Works, Storey's Gate, S.W.
(Lewisham, S.E.).—Additions to 181, 183 and 185, High Street. J. Watt, builder, Bromley Road, Deptford.
(Tooting, S.W.).—Three houses. J. S. Moyle & Son, builders, 16, Great Charlotte Street. S.E.
(Balham, S.W.).—Four houses. W. Wallis, builder, 207, High Road, Balham.
(Tooting, S.W.).—Shops in Mitcham Lane. Alder & Turrill, architects, Effingham House, Arundel Street, W.C.
(Clapham Park Road, S.W.).—Two halls for the Salvation Army, Queen Victoria Street, E.C.
(Streatham, S.E.).—Twelve houses, Mount Nod Road. F. T. Wooding & Son, builders, 3, Harborough Road, S.W.
(Putney, S.W.).—Four houses. E. J. Partridge, architect, Bank Chambers, Richmond.
(East Ham, E.).—Eight houses, Grosvenor Gardens. F. Hamlet, builder, Barking Road, East Ham.
(Clapham, S.W.).—Buildings and shops, Lyham Road. Dartnell and Banks, architects, 34, High Street, Croydon.
(Victoria Street, S.W.).—Shop. Westminster Trust, Ltd., 34, Victoria Street, S.W.
(Whitehall, S.W.).—Alterations to Treasury and Home Office (£3,000). H.M. Office of Works, Storey's Gate, S.W.
(Finsbury, E.C.).—Structural alterations to premises in St. John Street. A. Kent, architect, 33, St. Paul's Church Yard, E.C.
(Kingsway, W.C.).—Chapel. Trustees of Great Queen Street Chapel.
(Marylebone, W.).—Buildings in Horace Street and Molyneux Street. W. R. Phillips, architect, 114, Church Street, Paddington, W.
(Bow, E.).—Development of Grove Hall Estate. E. Evans, agent, 253, Lavender Hill, S.W.
(Leyton).—Sorting office extension (£2,300). H.M. Office of Works, Storey's Gate, S.W.
(Lombard Street, E.C.).—Branch post office (£3,500). H.M. Office of Works, Storey's Gate, S.W.
(Strand, W.C.).—Additions and alterations to Somerset House (£3,000). H.M. Office of Works, Storey's Gate, S.W.
(Hornsey, N.).—Sorting office extension (£2,200). H.M. Office of Works, Storey's Gate, S.W.

LOUGHBOROUGH.—Congregational school. Rev. W. J. Wray, pastor.

LUMLEY (Co. Durham).—Alterations and improvements at the Council School for the County Education Committee. A. J. Dawson, clerk, County Education Committee, Shire Hall, Durham.

LUTON.—Additions to the Conservative Club; lit by electricity.
Houses, Dordens Road, Leagrave, for R. Melcombe.
Putteridge House (mansion) to be rebuilt.

MACDUFF (N.B.).—Hydropathic on sites of Fife Arms Hotel, Commercial Inn, and Bayview Temperance Hotel for Dr. Walford Bodie, medical electrician. (All electromedical apparatus to be installed.)

MACHEN (near Cardiff).—Alterations and additions to Baptist Chapel. J. H. Phillips, F.R.I.B.A., Clive Chambers, Windsor Place, Cardiff.

MANSFIELD.—Houses, Beardall Street, for Geo. Frisby; Tennyson Street, for H. Blythe; Alexandra Avenue, for E. Shippam; Alexandra Avenue, for G. Butler, jun.; Brunt Street, for H. Smith; Carter Lane, for M. Morris.
Motor store, and workshop. Vallance & Westwick, architects, Mansfield.

MATLOCK.—Church at Hackney (£1,400).

MELKSHAM (Wilts.).—Liberal Club. R. E. Brinkworth, architect, 16, Old Bond Street, Bath.

MERSTHAM (Surrey).—Houses, Rockshaw Road. Paxton Watson, Adelphi, London, W.C.

NETHERTON (Yorks.).—Drapery stores for the Netherton Co-operative Trading Society, Ltd. W. Carter, architect, Station Street, Meltham.
NEWARK.—Extension of Newark Sunday schools (£250).
NEWPORT (Mon.).—Proposed training college and hostel at Caerleon.
NEWTOWN (Wales).—Welsh Calvinistic Methodist Chapel.
NORWICH.—Church in Sun Lane (£2,600).
NOTTINGHAM.—Addition of winter garden to the Midland Hotel.
OAKWORTH (Yorks.).—Projected rebuilding of the Hollings Mill.
OSSETT.—Town Hall in the Market Place. W. Hanstock & Sons, architects Batley, Yorks.
OLD DEER (Aberdeenshire).—Rectory. G. Davidson, architect, Auchnagatt, Aberdeenshire.
PAISLEY.—Shops and dwelling houses in Broomlands Street. T. F. Reid, writer.
PEMBERTON (near Wigan).—Proposed alterations at Castle Inn.
PENDLETON (Lancs.).—New Baptist church to be built in Nursery Street. Trustees, Baptist Church, Pendleton.
PLYMOUTH.—Houses at The Hoe, for J. H. Vincent.
POLSTEAD (Suffolk).—Alterations and repairs, and teachers' house at the Council school. T. R. Hughes, secretary, West Suffolk Education Committee, Shire Hall, Bury St. Edmunds.
PONTARDAWE.—Public hall (accommodate 1,500) and institute. W. B. Rees, architect, 3, Dumfries Place, Cardiff.
PORT SUNLIGHT.—New works for Mersey Chemical Co. (new concern).
PRESTON.—Wesleyan church (£5,000 to £6,000). Trustees of Tennyson Road Church, Preston.
(Yorks.)—Alterations and additions to the Council school for the E. Riding of Yorks Education Committee. Building surveyor, County Hall, Beverley.
PRESTWOOD (Bucks).—New elementary schools for the C.C. C. G. Watkins, education secretary, Aylesbury.
PURLEY (Surrey).—Meeting house for the Society of Friends (£1,000).
RAVENSTHORPE.—Houses, Clarkson Street, for Lee and Hampshire.
RICHMOND-ON-THAMES.—Shop and flats, Waterloo Place, Kew Green, for S. Blasby.
ROTHERHAM.—Council schools at Kimberworth for the Rotherham Education Committee.
Additions to Goldthorpe Institute. J. Fawcett, Doncaster Road, Goldthorpe, near Rotherham.
ROTHWELL.—Houses, Crispin Street, for R. Willis, and Evison Road for H. Phillips.
RUGBY.—Baths in Caldecott Park for the U.D.C. Council surveyor.
ST. AUSTELL.—104 dwelling houses, at Foxhole and Nanpean, for Mr. Stocker (West of England China Clay Co.), St. Austell.
ST. HELENS.—Houses, Heath Street, for T. I. Nuttall; Enfield Street, for J. A. Baron; Park Road, for G. Coupe, builder, Greenfield Road.
ST. IVES.—Workmen's dwellings.
SEAHAM HARBOUR.—Lifeboat house (£3,000). Campbell & Handman, builders, London.
SEDGEFIELD (Co. Durham).—Houses, Trimdon Grange, for Walter Scott, Ltd.; and Mainsforth, for Col. Surtees.
SELSEY (near Chichester).—Bungalow (£4,500) for B. Peters, Sunningdale (in building).—Longley & Co., builders, Crawley.
SHEFFIELD.—Enlargement of Chapeltown Church (£950); church at Over Heage, Belper (£900).
SKETTY (Swansea).—Elementary school.—W. E. R. Allen, deputy clerk, Glamorgan C.C., Cardiff.
SLOUGH.—Houses, Stoke Road, for Horlick & Co.; Chalvey Court Estate, for J. & W. Hibberd; Bath Road, for C. J. Jackaman; King's Road, for P. Perrin; and Uxbridge Road, for H. D. Bowyer, builder, Mackenzie Street.
SMETHWICK.—Six houses, in Bowden Road, for R. T. Clayfield, and 33 in Bowden Road, for A. T. Jennings.
SOUTHAMPTON.—Proposed lunatic asylum. Town clerk.
SOUTHEND-ON-SEA.—Houses, Belle Vue Place, for W. Bray, jun.; Tintern Avenue, for J. Knight; Grand Drive, for R. S. Tomlin; Glen Road, for F. S. Johnson; London Road, for Scott & Willerson; Victoria Drive, for Mrs. H. Chance; Eastwood Road, for J. Wyatt, J. Snelling and H. W. Grainger; Leigh Road and South View Drive, for W. G. Whitby; Glen Road, for J. J. Blanch; Broadway Market, for F. F. Ramuz.
Additions and alterations to the Esplanade Hotel, The Leas. T. H. W. Idris.
Laundry in Eastwood Road, for the Albany Laundry Co.
SOUTH SHIELDS.—Renovation and repair of Mile End Road Church. Rev. J. Brown Logie, minister.
New theatre, corner Frederick Street and Havelock Street, for Mr. A. Moody. J. W. Wardle, architect, 33, King Street, South Shields.
STAFFORD.—Golf club house for the Castle Golf Club.
Council schools at Anslow (accommodation 138), Rolleston (accommodation 132), and Tutbury (accommodation 328) for the Staffs. Education Committee. G. Balfour, Director of Education, County Education Offices, Stafford.
STIRLING.—Motor garage for Menzies Bros., cycle agents, Port Street.
STOCKPORT.—Ironworks in Bramall Lane, Haze Grove.
(Cheadle Hulme).—Infants' school for the County Education Authority.
SUTTON-IN-ASHFIELD.—Extension of the Particular Baptist Church (£2,000).
TILSTON (Mon.).—Primitive Methodist Church.
TON, PENTRE (Rhondda Valley).—Seven cottages at Ton Row, for Mrs. M. Evans. W. D. Morgan, M.S.A., architect, 194, Ystrad Road, Pentre, Rhondda.
TORQUAY.—Villas and bungalows on Cockington Estate.
TROWBRIDGE (Semington).—Ten cottages for Lord Methuen.
URMSTON (near Manchester).—New Council school. County Architect, Preston.
UXBRIDGE.—Post Office (£5,500). H.M. Office of Works, Storey's Gate, S.W.
WALKDEN.—Proposed deepening of shaft at Frank's Colliery, Little Hulton. J. Wallwork, mining agent, Bridgewater Offices, Walkden.
WARE.—Pumping station at Stanstead Abbotts, for the U.D.C. (£3,200).
WARWICK.—New Church at Wellebourne.
WELLINGBOROUGH.—Houses, Finedon Road, for Ireson & Sons; additions to the Priory, Church Street.
WESTON-SUPER-MARE.—Bank in High Street, for the London City and Midland Banking Co., Ltd., London.
WEST YORKSHIRE.—200 workmen's houses for a developing colliery. X 52, *Yorkshire Post*, Leeds.
WIDNES.—Strong room at the Town Hall for the T.C. J. S. Sinclair, borough surveyor, Widnes.
WIGAN.—Two houses off Billinge Road, for Mrs. Melling; bakehouses in Dawber Street, for Mrs. Laycock.
WINDSOR CASTLE.—Wash house, covered ways, &c. (£1,550). H.M. Office of Works, Storey's Gate, S.W.
WIRKSWORTH.—Improvements at the Town Hall.
WORLE (Somerset).—Infants' Schools for Somerset County Council) £1,688 H. W. Pollard, builder, Bridgwater.
WOMBWELL.—Houses, Blythe Street, for W. E. Wainwright; additions to works of the Municipal Foundry and Engineering Co., Ltd.
WREXHAM.—Great Western Station to be remodelled and extended, and luggage lifts added.
YARDLEY.—Alterations and additions to the New Inns, Coventry Road. W. D. Brooks, tenant.

## THE NATIONAL PHYSICAL LABORATORY.

With the issue of the report of the National Physical Laboratory for the past year, the Executive Committee has been able to render an account of much difficult work well done. The laboratories as now fitted at Bushy House, though of moderate dimensions, are representative of a high standard of achievement in all departments, and it is clear that Dr. Glazebrook and his staff have in every way upheld the traditions of this country in respect to physics. The inspection last Friday showed that several important extensions had been made to the buildings, especially to those designed for electro-technical measurements, and to those intended for photometrical tests. Looked at broadly, perhaps the feature that most struck the visitor was the evidence of increased complexity in every department of physical measurement. When we compare the apparatus of Davy or Faraday, of Weber or Cavendish, with the instruments of precision and the powerful mechanism assembled to-day at Teddington, we look with pride on the advances of the last period in the history of physics, but we think with perplexity of the vast empire of physical research and achievement that the youngsters of the present generation will be called upon to conquer. Physics is no longer simple, and progress in physics is no longer easy; the general tendency is towards increased elaboration, clearer insight, better co-ordination, improved methods, more concise records.

Of the newer testing apparatus on view last Friday, we noticed especially the new abrasion testing machine for determining the behaviour of steel or other materials under the action of periodic stresses. This is intended apparently for the investigation of steel for rails, and for similar purposes. The specimen is formed into a small ring, which is slipped over a mandrel, upon which it is free to turn. It is rotated by three hardened steel rollers that make normal rolling contact with it at three equidistant points of the periphery, and it is consequently subjected to a varying crushing and rotatory stress. A point is generally reached at which the ring breaks, and it can then be examined as to change of dimensions, and as to fracture. It is usually found to be marked with a large number of transverse fractures. Another addition of some interest is the new 100-ton Buckton testing machine. A small but important refinement is now introduced in the application of longitudinal stress when testing bars of material such as copper. The limiting stress, as is well known, is a function not merely of the load, but of the rate at which the load is applied. A copper wire resists a much greater sudden load than it can support when a similar load is gradually applied. The reason of this, of course, is that the corresponding strains are functions of the time, and it thus takes an appreciable time for the position of maximum weakness of the internal parts to be attained. To take account of this relationship the testing machine is actuated at known speeds, which can be adjusted by gearing. Impact is being studied with great care in this department, and it is instructive to observe the specimens of steel which have been broken by a sequence of gentle taps. Here again the question of the rate of applying the impacts is being taken into account, and it is found that even when the action is comparatively slow, and the blows moderate, the steel is, as it were, demoralised by the process of disturbance which fidgets the material into a condition of physical breakdown, so that it soon loses its elasticity.

In the thermometric department progress is being made in connection with the measurement of the specific heat of steam, and improved apparatus is now in course of construction. Experiments were proceeding with regard to materials for covering steam-pipes. We noticed also

an "induction" furnace of considerable interest. Material required to be brought to an excessively high temperature is placed in an annular channel which forms a single "turn" round the built-up iron core of a transformer frame. An alternating current is sent through the primary coils, and the current induced in the furnace ring produces the required temperature. The primary coils are copper tubes, cooled by water flowing through them.

The equipment of the electro-technical department, which was fully described in our issues of June 22nd & 29th, 1906, shows evidence of advance, but the installation of some of the heavier parts of the testing plant has yet to be completed in the new building. The arrangements for testing voltmeters over a long range are particularly well thought out. It is satisfactory also to see the progress that has been made with the new standard of mutual inductance. The calculation of the dimensions of this remarkable standard, and the construction of the coils and their supports, must have entailed a vast expenditure of labour, and while congratulating Dr. Glazebrook and Mr. Campbell upon the success of their work, we look forward with confidence to the results that this apparatus holds in promise.

## FORTHCOMING EVENTS.

**To-day's Events** (Friday, March 27th).—At 9 p.m. Royal Institution. Discourse on "The Radio-Active Change in the Earth," by Hon. R. J. Strutt, M.A., F.R.S.

At 5 p.m. At the Northampton Institute. Physical Society. Dr. C. V. Drysdale on (1) Notes on the Plug Permeameter; (2) The use of Shunts and Transformers with Alternate-Current Measuring Instruments; (3) Wattmeters.

At 8 p.m. At Cannon Street Hotel. Electro-Harmonic Society. Last Smoking Concert of the season.

Saturday, March 28th.—At 3 p.m. Liverpool and District Electrical Association. Visit to ss. *Lusitania* (if in dock).

At 3 p.m. Royal Institution. Lecture on "Electric Discharges through Gases," by Prof. J. J. Thomson.

At 10 a.m. Institution of Electrical Engineers. Students' Visit to the Thames Ironworks. Meet at the works.

Monday, March 30th.—At 8 p.m. Royal Society of Arts. Cantor Lecture on "Fuel and its Future," by Prof. V. B. Lewes. (Lecture 4.)

Tuesday, March 31st.—At 7.30 p.m. At the University, Manchester. Institution of Electrical Engineers (Manchester Section). Paper on "Electrolytic Corrosion," by Prof. W. H. H. Gee.

At 8 p.m. At Anderton's Hotel. Finsbury Technical College Old Students' Association. Smoking concert. Mr. G. F. Redfern, president.

At 8 p.m. Institution of Civil Engineers. Paper on "Some Methods of Heating Adopted in Hospitals and Asylums Recently Built," by E. R. Dolby.

Thursday, April 2nd.—At 8 p.m. At Caxton Hall, S.W. Civil and Mechanical Engineers' Society. Paper on "Efficiency of Boiler Heating Surface," by Mr. C. H. Wingfield.

At 8 p.m. Royal Society of Arts. Howard Lecture on "The Navigation of the Air," by H. S. Hele-Shaw. (Lecture 3.)

At 8 p.m. At the Institution of Civil Engineers. Institution of Electrical Engineers. Paper on "High-speed Electrical Machinery," by G. Stoney and A. H. Law.

Friday, April 3rd.—At 9 p.m. Royal Institution. Discourse on "The Modern Motor-Car," by the Rt. Hon. Lord Montagu of Beaulieu.

Saturday, April 4th.—At 3 p.m. Royal Institution. Paper on "Electric Discharges through Gases," by Prof. J. J. Thomson.

## NOTES.

**The Franco-British Exhibition.**—Like all previous exhibitions, the one to be opened in state on May 1st next, is, at present, in a very unfinished condition. It is now affirmed that the King, or President Fallières, or both will take part in the opening ceremony, and there can be no doubt that every effort will be made by the energetic managers to make a good show on that occasion. They have had difficulties to contend with which would have appalled less capable men, and it must in fairness to them be stated that they have, so far, had but little assistance from either the Government, the local authorities, the exhibitors, or the contractors. The Government have given no pecuniary help whatever; the local authorities have not relaxed their rigid building rules in any degree, even for erections of a manifestly temporary character; the exhibitors in the British Isles have as usual been very backward in coming forward; and the contractors have, in many cases, suited their own convenience in delivering materials without any regard whatever to the general progress of the undertakings. In spite of all this the progress of the work has been wonderful, thanks in a great measure to the weather, which on the whole has been most favourable.

As mentioned last week the French have risen to the occasion; the Government are co-operating liberally with the exhibitors, and the City of Paris will have a pavilion of its own, while the City of London and the London County Council will not be represented at all, except as regards the latter by their tramways along Wood Lane. Access to the grounds will be facilitated by new approaches and stations on every line of railway, while the main entrance will be through a series of buildings reaching from the Uxbridge Road at Shepherd's Bush to the first pavilion of the Exhibition proper, viz., that devoted to electricity. This and the adjoining industrial section are now roofed in, and the sides are being slabbed—a work which goes on with great expedition. Passing through these we come to the Court built in the Indian style, at the further end of which the Congress Hall has its roof and domes completed. On either flank are the buildings for French and British Industries, which are complete except the flooring and a little of the side slabbing. The Hall devoted to Education leads out of the British Industries section, and is not yet floored.

The next court is devoted entirely to the Fine Arts, and the Imperial Tower will form an effective feature of its north end. Passing through this we arrive at what may be called a "Garden" Court devoted to the Royal Pavilion, and to clubs and restaurants; on the right or east of this is the magnificent stadium, which will be completed in time, although the buildings connected with it are not much in evidence at present. On the left, or west, is an enormous building for the display of machinery. This is in a very advanced state, and is, in fact, quite ready for its contents, which will be brought right into it, and be distributed by five lines of rails running to all parts of the three halls. These lines will be connected with the West London Extension Railway by a siding leaving the main line between the Shepherd's Bush and Wormwood Scrubbs Stations, crossing Wood Lane and the L.C.C. tramway on the level, and running right round the outside edge of the grounds. This is now in progress, but no rails have been laid down yet.

To the north of what we have called the "Garden" Court are a number of side shows, in which enormous masses of steel have been used; but at only one of them, the so-called "Flip-flap," have the contractors had the foresight to lay down a railway from a gate to their work, and to put up a crane at the entrance wherewith to transfer the heavy loads from carts to rail lorries. At the northern end of the grounds the Colonial Buildings, both French and English, are ranged in a semi-circle, at the crown of which is the Indian Pavilion, a beautiful example of Saracenic design, the most pleasing and most advanced building of all.

Many big ironworks will send samples of metals; one plate, for instance, is expected 93 ft. long 6 ft. wide, and 1½ in. thick. How it is to be brought on the ground is not very clear.

The French railways intended sending over many examples of their rolling stock. Unfortunately, as a rule, it fouls our high platforms by no less than 9 inches.

Power and light will be procured from the Hammersmith Borough Council's power station. There will be a 2,000-kw. installation; one Parsons turbine with Babcock & Wilcox boilers will work two dynamos in tandem. There will also be a 1,000-h.p. gas engine and Mond plant, the biggest ever shown.

**Electrolytic Copper Production in France.**—A remarkable claim has just been put forward in respect of the efficiency of the process devised by M. Lafontaine for the production of electrolytic copper, chemically pure, by the direct treatment of copper ores and of scrap or waste metal. The process is under the aegis of the Société Française Electrolytique, which has erected works in Rue Castagnary, Paris, and equipped them for the purpose of practical working. The plant includes 50 vats, of a capacity of about 4,000 litres, for the baths, in which scrap or waste copper is placed at one of the poles—the anode. The *Moniteur Industriel* states that during the first three weeks' operation 50 vats were energised, and that the number of cathodes withdrawn was 700, the average weight of each cathode being 26·35 kg. The number of hours worked was 552, the total weight of electrolytic copper obtained was 18,445 kg., and the efficiency per ampere-hour is said to have been 1·503 gramme, or 27 per cent. in excess of the theoretical efficiency, and 50 per cent. higher than ordinary processes hitherto carried out. On the other hand, it is submitted that, with the other methods used down to the present, the copper must possess the maximum of purity before being placed in the bath. Thus at Biache-Saint-Vaast the ore is melted and brought up to 95 per cent. of copper, and at Birmingham the copper for the anode is prepared at 99 per cent. It is claimed, however, that the Lafontaine process dispenses with this costly and delicate preparation of the anode. During trials recently made it is stated that the anode-vessels were charged with scrap or waste containing various alloys, such as zinc, tin, iron, and even nickel, and these were neither sorted, analysed or melted. The deposition at the cathode was active and regular, and three groups of cathodes showed the following results:—

| | Exact weight of each cathode in kilogrammes. | | | Total weight. |
|---|---|---|---|---|
| Vat No. 1 ... ... | 25 | 26 | 31 | 82 |
| " " 26 ... ... | 24 | 30 | 35 | 89 |
| " " 50 ... ... | 27 | 29 | 30 | 86 |

These results are declared to prove that the deposition was equal, that there was no loss of power, and that the resistance was reduced to a minimum. The copper obtained by the process is of a granular form and of good merchant quality. The French journal states that after having passed through the rolling mill, the copper will fully answer the demand for good electrolytic material.

(*Continued on page* 537.)

# THE ELECTRICAL INDUSTRY IN FRANCE.—II.

By GEORGES DARY (Paris).

The system of the Société Meridionale de Transport de Force is one of the most interesting of the large undertakings in France, for hardly is one section completed ere an extension of the area of supply becomes necessary and a supplementary station has to be built. This is so because the demand increases, until the electric mains extend in all directions like a spider's web, which is gradually being spun closer and closer. The system already extends over almost two departments, and is connecting itself, practically without any break, with the huge system in the south-east. There are, in fact, over 375 miles of high-tension mains, extending a distance of a little over 80 miles between the generating station and the farthest points of consumption. An examination of the accompanying map (fig. 2) will give an idea of the importance of this immense system, which, starting from the initial plant at St. Georges, and the new auxiliary Aguzou station at the bottom of the Gorges de l'Aude, extends as far as to supply Beziers and Maraussan, in the Herault. The original St.

Fig. 1.—View of Works and Pressure Pipes, St. Georges.

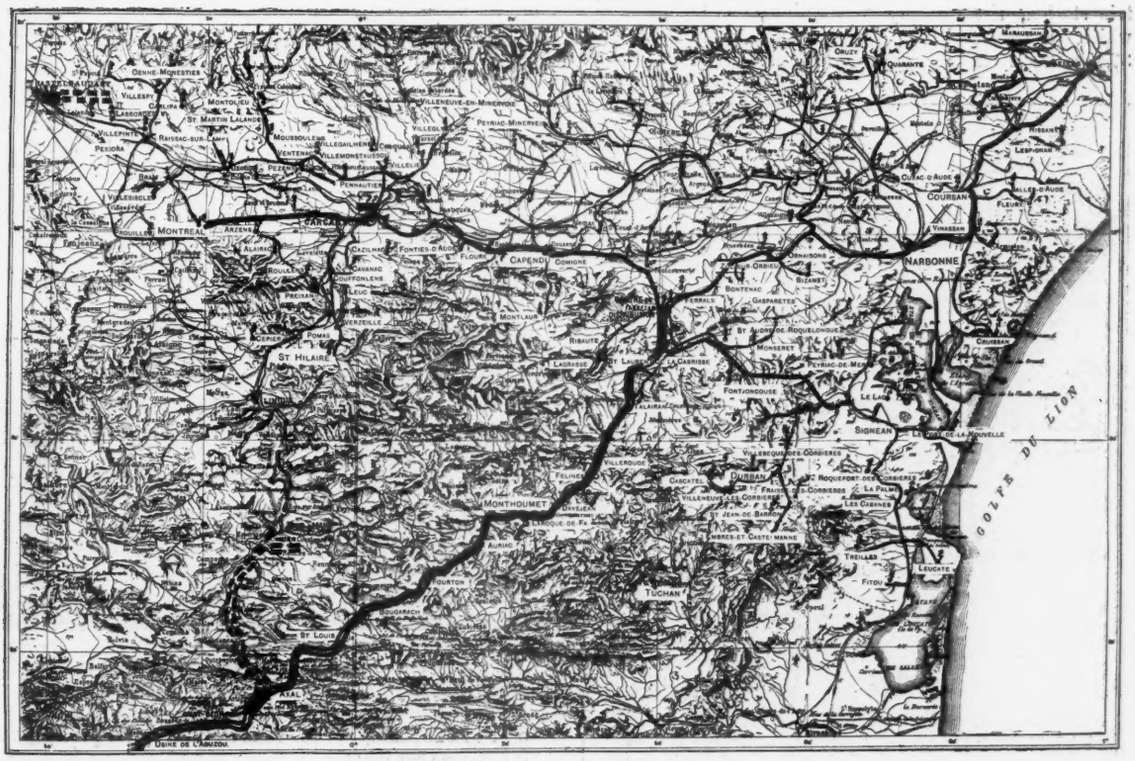



Fig. 2.—Distributing System of La Société Meridionale de Transport de Force.

Georges station (fig. 1), situated in the gorges of the River Aude, 1¼ miles from the little town of Axat, utilises a fall on this river, having a height of a little more than 320 ft. The plant was established in 1899, and has since supplied a three-phase current at 20,000 volts, by means of a feeder about 44 miles long, to a first distributing centre located at Fabrezan. From this centre radiate three branches—the first running to Narbonne, the second to Carcassonne, and the third to La Nouvelle. These three branches supply energy direct to all the places on the route, but further, and mainly serve to feed the three distribution centres named, the high-tension current being there reduced to a medium voltage, and it is from these secondary centres that the real supply mains radiate. As we have pointed out, this original station soon became unequal to meet the demand, with the result that, in 1906 and 1907, three auxiliary stations were established—the first at Aguzou, the second at Narbonne, and the third at Carcassonne—while now new principal lines are projected at Castelnaudary, Couiza, Tuchan, &c., the system being extended every year. All the stations can be run in parallel or feed different sections, while those at Narbonne and Carcassonne are equipped with steam engines and continuous-current dynamos, in addition to the synchronous and asynchronous motors fed by the St. Georges and Aguzou plants.

At the St. Georges hydro-electric station, the masonry water dam, which is situated on the Aude, 37½ miles from its source, a little

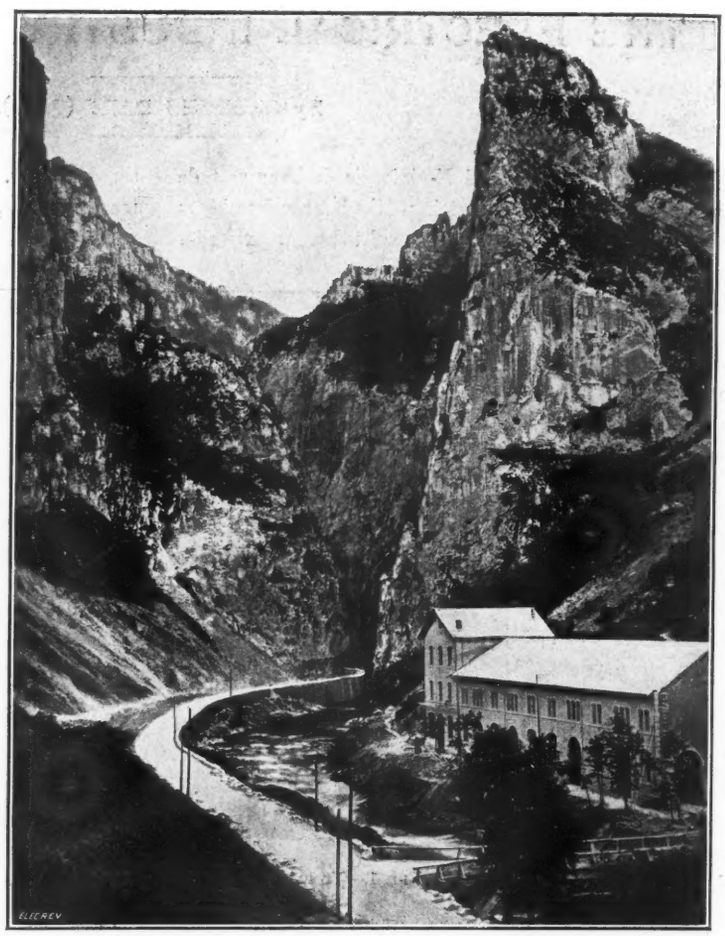


Fig. 2a.—View of the Generating Station, St. Georges.

Fig. 3.—Ferro-Concrete Head-Race.

above the village of Gesse, forms an intake 131 ft. long; it has two discharging sluices and represents a reservoir of 529,650 cb. ft. The conveying channel has been designed for an average supply of 211 cb. ft.; it is underground for 3½ kilometres and open for 1½ kilometres, the total length thus being 5 kilometres (3⅛ miles). The open part of the channel (fig. 3) is constructed of reinforced concrete and is supported on columns of similar material to carry it across the valleys (fig. 4). It is practically of a rectangular section, 6½ ft. × 6½ ft., with a uniform slope

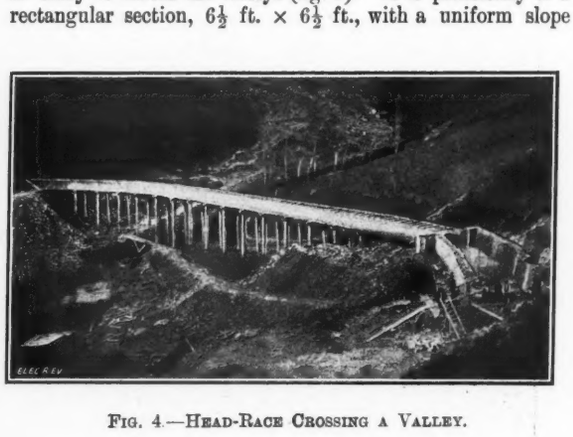
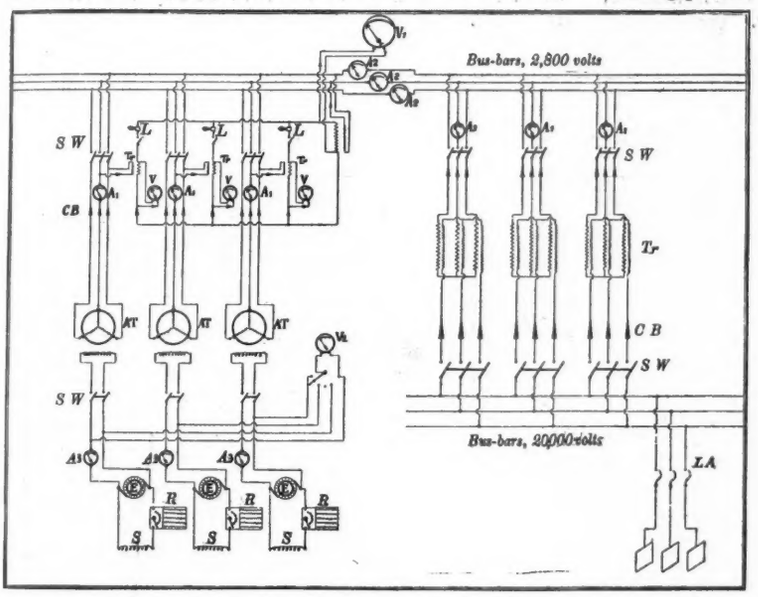


Fig. 4.—Head-Race Crossing a Valley.

of 1 in 625, except in the reinforced concrete portion, where it is somewhat greater.

About 200 yards from the station is the overflow and water-collecting chamber whence lead the pressure supply pipes. Gratings and sluice-valves are fitted to each of these pipes, four of which are provided for. Two are actually at work (fig. 1); they are of tubular section, 3·28 ft. diameter and built of sheet steel in lengths of 3 metres (9 ft. 10 in.) riveted together. Each pipe delivers 352 gallons per second at a speed of 2 metres (6·56 ft.). The

total fall between the retaining chamber and the tail-race is 332·5 ft. The pipes are 524 ft. long, but at a point about 40 ft. above the station each one divides into two smaller pipes of a diameter of 27½ in., each supplying one turbine.




$A_1$, $A_2$, $A_3$, Ammeters; A T, Three-phase alternators; C B, Circuit breakers; E, Exciters; L, Phase lamps; L A, Lighting arresters; R, Regulating rheostats; S, Exciter fields; S W, Switches; TT, Transformers; V, Voltmeters.

Fig. 6.—Switchboard Connections.

The generating station is of a rectangular shape, the centre portion containing the engines, turbines and alternators; in the wings, on either side, are the transformers, the high-tension switchboards, repair shops, &c.

The four turbines, built by the Ateliers de Vevey, are of the Pelton type, with horizontal shaft; they run at a speed of 300 R.P.M. The turbines, which are provided with automatic speed regulators and hydraulic servo-motors, utilise the water at the pressure due to the fall, the water passing through a filter ere it reaches the turbines. The shaft of the latter is 11 ft. 6 in. above the level of the water in the tail-race. This height is, however, not lost, for by means of a special arrangement which allows the air to return and prevents the turbine being flooded, a column of water mixed with air is maintained in the pipe, and produces a relative vacuum, which allows a part of the 11 ft. 6 in. of fall to be regained, which it would have been impossible otherwise to utilise. The variation in speed of the turbines for sudden differences in load of 50 per cent. is only 4 per cent., and for 100 per cent. it is less than 10 per cent. The efficiency, on full load, is 77 per cent. The turbines are direct-coupled to Alioth 700-KW. alternators (fig. 5), generating at 2,900 volts with a frequency of 50; the exciting machines are mounted on the ends of the alternator shafts, and furnish 25 amperes at from 50 to 60 volts. The efficiency of the alternators is 93 per cent. at full load; they weigh 35 tons, of which the rotating portion is responsible for 12 tons.

The step-up transformers, which are of the Alioth single-phase type, raise the pressure from 2,800 to 20,000 volts. They are twelve in number, and are arranged star-shape in sets of three, thus forming four three-phase groups of 600 KW. capacity. They are air-cooled and placed in a special room, the ventilation of which is effected by two large angular flues.

The switchboard is in two parts (fig. 6); the first is divided into four panels for the alternators, which run in parallel on bus-bars. From the latter run the primary circuits for the transformers. The second portion of the board is devoted to the high-pressure system, and comprises switches operated by compressed air, the fusible cut-outs, and the high-tension (20,000 volts) bus-bars. The whole of the switchboard frame is of iron, and the connections are carried on insulators of the same type as those used on the line. Finally, a group of switches with a measuring transformer, the primary of which is connected to a voltmeter, permits the pressure between the wires, and between the wires and earth, to be indicated at each or any instant, it being possible thus to detect any faults in the line while working. A platform carried on insulators allows access to the switchboard without danger. The high-tension cable is led out of the station through oblique holes formed in the wall.

Fig. 5.—Pelton Turbines Driving Alioth Alternators.

Since the establishment of the Aguzou plant the switchboard has had added to it the cables from this station, which can be connected with the bus-bars so that the two stations can be run in parallel; in this case, the coupling up may be either with St. Georges or Aguzou. It will be understood, of course, that they can run independently of each other,

and feed any of the systems as desired, or in case of need. The Aguzou station contains a turbo-alternator set of 1,250 H.P., with transformers similar to those at St. Georges. This capacity is, however, merely temporary, as no sooner was the Aguzou station built than its capacity became insufficient, and it is about to be increased to 4,000 H.P.

The Narbonne station, which at first was only provided with asynchronous motors, and merely formed a distributing sub-station, was, in 1905, equipped with a 900-H.P. Weyher-Richmond steam engine and Alioth three-phase alternator of 875 KW. capacity at 2,800 volts. This pressure is raised to 17,000 volts by a group of transformers with forced-draught cooling, a three-phase motor driving a fan being employed to direct a powerful current of air between the coils and core.

Finally, it may be mentioned that the Carcassonne station comprises two parts —one hydraulic and the other steam-operated—which feed the continuous-current, three-wire system, at 200 volts. The capacity is from 800 to 900 H.P., steam engines having been added to the turbines as the demand has increased.

As sub-stations, the plants at Narbonne and Carcassonne are equipped with sets of 150-KW. transformers, each composed of an Alioth 225-H.P., 500-volt asynchronous motor coupled to a 200-volt continuous-current dynamo; the groups being fed by a 200-KW. three-phase transformer.

The work of establishing the supply lines was particularly carefully carried out with the view of ensuring perfect working. The lines from Aguzou and St. Georges consist of cables of a section of 20 sq. mm., supported on columns erected at an average distance apart of 262 ft. The feeder, 43¾ miles long, which runs from St. Georges to Fabrezan, consists of three cables of a section of 38 sq. mm. placed in the form of an equilateral triangle at a distance of about 23⅝ in. from each other. The masts are 32 ft. 9 in. high, and are set at every 131 ft.; they are not impregnated, but have been covered with boiled carbonyl. Large triple-bell insulators, which have been tested up to 40,000 volts, support the conductors. A telephone line, carried on the same masts, but at a distance of 6½ ft. below the high-tension line, connects St. Georges and Aguzou with Fabrezan, the distributing centre. These wires are crossed at every tenth mast in order to destroy the effects of induction.

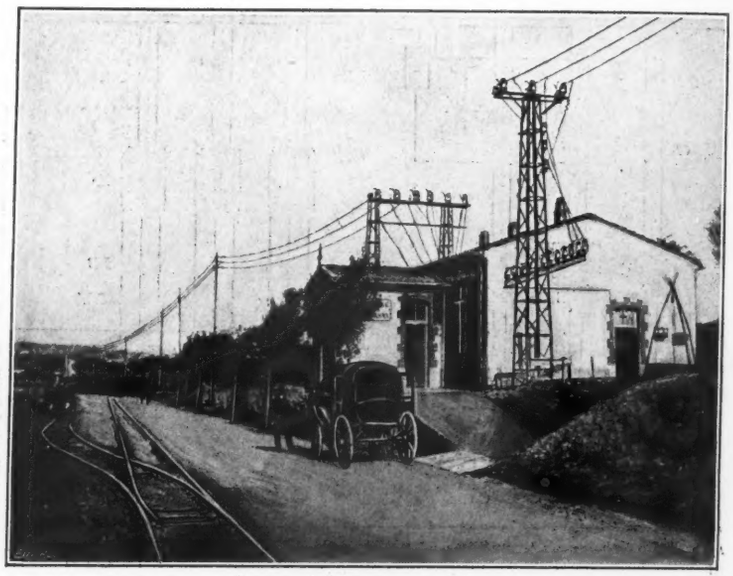


Fig. 7.—Central Distributing Station at Fabrezan.

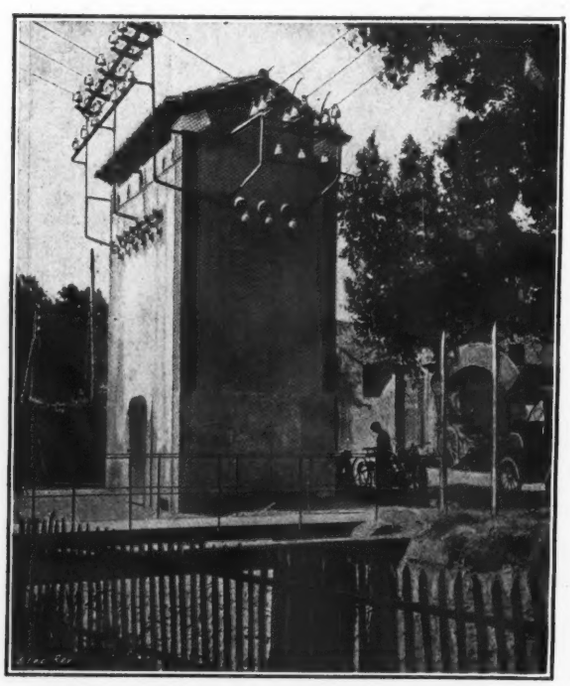


Fig. 8.—Transformer Sub-station (17,000—5,500 volts).

M. Estrade, the founder and director of the company, and M. Choulet, the engineer-in-chief of the system, have organised an excellent plan of line inspection. Every 6¼ miles, is located a linesman living in a special house, his duty being to daily inspect the section entrusted to him. Each of the houses is connected by telephone with the central station, and a record is kept of the daily reports of the inspecting linesmen. These men are controlled by a number of under-chiefs of the system, who in turn are under the orders of a chief residing at Fabrezan, the latter being responsible to the engineer-in-chief. From this it will be gathered that the inspection of the line is effected on a well thought-out plan, which materially aids in the efficient operation of the system.

Every Sunday from 2 a.m. to 3 p.m. the current is cut off and all urgent repairs are effected. The extreme care in inspecting the line is rendered necessary by the fact that the district is very hilly and the course of the feeder is very irregular; it starts at a height of 1,410 ft. above sea level, rises to 3,280 ft. in the Forest of Fauges, passes round the foot of the Bugarach Peak, and after remaining for some time at 2,624 ft., finishes at Fabrezan at a height of 656 ft. The wind is often very violent and in winter the insulators are occasionally entirely covered with snow.

At Fabrezan (fig. 7), the central distributing station contains a large receiving and distributing switchboard, with switches, circuit-breakers, amperemeters and voltmeters. The principal branches which emanate from this point are three in number; one goes to Narbonne (18¾ miles), another to Carcassonne (22 miles), and the third runs towards the sea coast as far as La Nouvelle and Fitou. The branches are all at 17,000 volts.

All the villages on the line of route are directly supplied by transformers, which reduce the pressure from 17,000 volts to 125-130 volts; for those which are not passed through by the line, the pressure is first reduced from 17,000 to 5,500 volts, new lines at the latter voltage radiating round the secondary distributing centres.

These secondary centres comprise transformers of an average of 100 KW., located in special kiosks, with switches, circuit-breakers and lightning conductors. In addition, these centres contain a transformer, reducing the pressure from 5,000 to 125 volts for the neighbouring localities supplied by the centre (fig. 8).

In this way it has been possible to considerably curtail the

inspection of the high-tension system, the insulation of which is much more difficult to maintain than one of 5,000 volts.

Where the 20,000-volt lines cross the railway of the Midi Co., the cables are enclosed in lead, paper-insulated, and pass under the rail track; they are connected with the overhead lines by special junction-boxes.

The financial and industrial aspect of the undertaking has been well conceived, and gives, by reason of the careful organisation, excellent results; it is based on a plan which, according to M. Blondel, who drafted the report of the Commission des Distributions d'Electricité, constitutes an ingenious method of developing the movement in favour of municipal lighting installations.

It is due to this that it has only been necessary for the Société Meridionale de Transport de Force to establish, at its own cost, the generating station and the high-tension lines. The rest has been carried out at the cost of the districts supplied. The public lighting is undertaken without charge to the extent of 30 16-c.p. incandescent lamps per 1,000 inhabitants, during 50 years. The system belongs to the local authority, but the company reserves the right of using it for a period of 50 years. Private lighting is generally undertaken by contract at a rate of 32 fr. (25s. 6d.) per 16-c.p. lamp per year. Practically speaking, no electricity meter is employed, its place being taken by a special apparatus known as a "basculateur" or "limiteur de courant," devised by M. Estrade, which in private installations prevents more lamps being lighted than are allowed by the contract. When this is done a mercury vibrator is set in motion and causes all the lamps to flicker, this not ceasing until the current passing in the interior wiring is reduced to the permitted quantity.

A large part of the energy is distributed for power purposes to the many industries in this large region—saw-mills, wood pulp plants, ice factories, and pumps for raising water for the watering of vines. In the last-named application, examples of which are to be found in every district, the three-phase motor is connected to the pump by a cut-out of the Choulet type, which works automatically, and requires no attendant. All the electrical and mechanical part of the installation has been supplied to the Société d'Applications Industrielles, who have employed Alioth electrical material exclusively.

The receipts are sufficient not only to cover the working expenses, but also to permit of a fair dividend. This first example affords a noteworthy proof of the statement that excellent results can be given by the electrical industry in France, when the organisation is carefully planned, and when water-power, with a high-tension system of distribution, enables a very large area to be supplied with energy at a cheap rate. The second example furnished by La Société du Littoral Mediterranéen—although of another type—fully confirms this opinion.

## NOTES.

*(Continued from page 532.)*

**An Electrically-driven Ice Saw.**—The demand for ice at the Burnley Municipal Ice Factory has grown during the last two or three years to such an extent that the cost of labour required to saw the blocks of ice as manufactured into marketable sizes, which was performed by manual labour, had become a very heavy item in the cost of production. Some little time ago an electrically-driven circular saw was installed to supersede this manual work. The output of ice from the works is about 10 tons a day in the summer. The ice is manufactured in blocks weighing 5 cwt., and measuring 4 ft. 2 in. × 2 ft. 6 in. × 1 ft.; these have to be sawn into 5 blocks each weighing 1 cwt. To saw one tank of ice (7 tons) took two men six hours with a cross-cut saw; with the new machine one man can saw a tank in 30 minutes, at a cost of 2½d. for current. The saw, which was built by Dent & Holt, Newtown Ironworks, Burnley, to the design of Mr. Pilkington, the manager of the Cold Air Stores, has one or two noteworthy points. There are two saws on one shaft, 31½ in. dia., and 10 in. apart; the frame that carries the saws is made to travel backwards and forwards, operated by a friction clutch which is controlled by a pedal and the sawyer's foot, so that the ice remains stationary on the machine and the saws travel through it. The saws are so spaced that they cut a block into five blocks in two operations, first cutting two blocks off the end, then cutting the remainder into three. The motor employed is a Dick, Kerr 5-h.p. 440-volt shunt-wound machine, standard type, running at 1,100 r.p.m., the speed being reduced by belts and countershaft to give 850 r.p.m. on the saw-blades. The machine has been running some weeks now, and has proved itself highly satisfactory, both in the way it does its work and in, what is perhaps more important, the cost of doing it.

**Late Legal.**—Re Tramway Arbitration.—In the matter of the Arbitration Act, 1889, and in the matter of an arbitration between the North Metropolitan Tramways Co. and the Leyton Urban District Council, the Court of Appeal consisting of the Lord Chief Justice, the President of the Probate, Divorce and Admiralty Division, and Lord Justice Farwell, on Monday, March 23rd, had before them the appeal of the North Metropolitan Tramways Co., from the order of Justices Phillimore and Walton, sitting as a divisional court, dismissing an appeal against an award.

Mr. Danckwerts, K.C., in support of the appeal, said the question arose in connection with an award made by Mr. Graham Harris under the Metropolitan Tramways Co.'s Act of 1870, in regard to the part of their undertaking within the district of the Leyton Urban District Council which had been compulsorily taken under the Local Act. The question was whether Mr. Harris had dealt rightly in connection with certain car works and land. The Court had to decide whether or not the local authority could be compelled to take and pay for the car works. At present the decision was against him, but he submitted—on the authority of a case in the House of Lords—that where the car works were suitable and within the district the local authority was bound to pay for them. A second point for the appellants was that the arbitrator had given the local authority the permanent way of the tramway including the entrance gates which were off the street, and had awarded nothing whatever for the value of the land. Mr. C. A. Russell, K.C., argued the case for the respondents.

The Lord Chief Justice said he was satisfied there was no obligation on the local authority to buy this particular bit of soil and the car factory, which was on private property. He thought substantial justice was done by the award. The other judges concurred.

The appeal was accordingly dismissed with costs.

City of London Electric Lighting Co., Ltd., v. Vanguard Motor-'bus Co., Ltd.—In this action, the hearing of which was commenced before Mr. Justice Ridley and a special jury in the King's Bench Division on Tuesday, the plaintiffs sued for £75 odd damage done to an electric lamp standard and lamp in Threadneedle Street, through the alleged negligent driving of the defendants' servants, or for the putting on the streets of vehicles which the defendants knew to be dangerous. The defendants admitted the injury to the lamps, but denied negligence. The jury found for the plaintiffs on the ground of negligence, but they held that the vehicle was not a legal nuisance. His Lordship gave judgment for plaintiffs for £43. A stay of execution was granted in view of an appeal.

**Copper.**—The Berlin correspondent of the *Financial News* says that, according to the annual copper report of Aron Hirsch & Son, just published, the world's production of copper for 1907 is estimated at 706,460 tons, as against 752,900 in 1906, 693,700 in 1905, and 644,800 in 1904. Of this total the United States leads the way with an output of 373,660 tons (compared with 417,400 in 1906); next comes Mexico with 58,000 tons (60,000 in 1906); the Iberian Peninsula (Spain and Portugal), with 51,000 tons (as in 1906); Australia, 46,000 tons (43,000); Japan, 40,000 tons (43,000); Chili, 28,000 tons (30,000); Germany, 24,300 tons (26,000). The exports from the United States to Europe rose from 205,450 tons in 1906 to 228,836 tons in 1907, while the accumulated stocks in the United States amounted to 113,767 tons at the end of last year, as against only 52,369 tons at the close of 1906. It must be borne in mind, however, that unrefined copper is included in the total for 1907.

The world's consumption of the metal during the year 1907 is estimated at 680,090 tons, as against 787,564 tons in 1906, 742,141 tons in 1905, and 674,427 tons in 1904. It will therefore be seen that the production of copper last year exceeded the consumption by 26,370 tons, while in the preceding year the contrary was the case, consumption exceeding output by over 34,000 tons.

Among the world's consumers of the metal, North America holds pride of place with 214,120 tons, as against 316,964 tons in 1906; Germany takes second rank with 160,217 tons, as against 163,098 tons; then comes England with 118,430 tons, as against 121,256 tons, and France with 70,712 tons, as against 68,927 tons.

**Overhead Lines in the Transvaal.**—A Government Notice was recently published by direction of the Minister of Mines promulgating regulations to be observed in the construction and maintenance of aerial electric power lines. The text of the regulations may be consulted by persons interested at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

**Electric Shock Fatalities.**—At Kirkcaldy the other day Sheriff Armour and a jury held an inquiry into the circumstances attending the death of a pitworker. Deceased was putting corrugated iron sheeting over the wooden casing which contains the electric cables when he drove a nail through the casing and received a shock which caused instant death. The jury returned a formal verdict of "Accidental death," but added a rider stating that, without imputing blame to anyone, they were of opinion that the miners should be more familiar with what was necessary when accidents of that nature occurred.

**Fatality.**—It is reported that, while at work on the electrification of the London, Brighton and South Coast Railway on 19th inst. two men were knocked down by a train at Clapham Road Station. One was killed and the other injured.

**The Manchester Exhibition.**—A correspondent informs us that at the meeting of the promoters, held in Manchester on Tuesday, various details were settled, and the proceedings of the Sub-Committee were confirmed.

**X-Ray Martyr.**—A sum of £800 has been raised on behalf of Dr. Hall Edwards, and it is gratifying to record that a Civil List pension of £120 has been granted to him by the Government. We regret to add, however, that in addition to the loss of his left hand, Dr. Edwards is about to lose the fingers of his right hand.

**Dance.**—The annual dance of the employés of the Paisley District Tramways Co. took place last week in Johnstone Town Hall. At supper subsequently, Mr. Fred Coutts, the general manager, referred to the work of the Recreations Committee and the men's benefit society.

**Institution and Lecture Notes.**—Physical Society.—At the meeting held on March 13th, 1908, a paper on "The Distribution in Electric Fields of the Active Deposits of Radium, Thorium and Actinium," was read by Mr. S. Russ, and a "Note on certain Dynamical Analogues of Temperature Equilibrium," by Prof. G. H. Bryan, was read.

Society of Road Traction Engineers.—On Monday last, at the Hotel Cecil, Mr. Percy Frost-Smith read a paper on "The Development of Petrol-Electric Systems, and their Application to Heavy Road Vehicles."

Royal Institution of Great Britain.—Yesterday afternoon Dr. R. T. Glazebrook was to deliver his second lecture on "Standardisation in Various Aspects," electrical engineering being discussed. The following is a synopsis:—Early history of electricity—Coulomb's law—Oersted—Ampere—Ohm—Definite numerical relations possible—Current—Electromotive force—Resistance—Gauss—Weber—Absolute units—The C.G.S. system—Kelvin and the British Association Committee—Realisation of the units—The ohm, methods of determination, results—The ampere and the volt, methods of determination, results—The international system of units and its connection with the C.G.S. system—International standardisation of fundamental units—Electrical Congresses—The Engineering Standards Committee and its work—Standardisation of machines and materials—Standardisation of incandescent lamps—The International Electrical Commission and its work—Standardisation of nomenclature and of symbols.

Electrical Contractors' Association.—At a recent meeting of the Association an interesting paper was given by Mr. Gaster on the subject of metallic filament lamps. He traced the development of the incandescent lamp from the early days to the present, and exhibited some metallic filament lamps of the most recent kind, some of which were capable of burning on 200-volt circuits. The latter are not yet on the market as a commercial commodity, but it is hoped that before many months are over they will be. Mr. Gaster pointed out that the trouble in making these lamps up to now was due largely to the difficulty in supporting the very long filaments necessary; this had now been successfully accomplished by means of carbon spring suspension, the springs being anchored to the top of a central pillar, and the arrangement of the filament being much the same as in the tantalum lamp. The lamp shown would burn at any angle, and gave 35 C.P. at a rate of 1 watt per candle. The lecturer pointed out that it did not pay to use metallic filament lamps when the cost of electricity was less than 2d. per unit for lighting purposes. A very interesting discussion followed the reading of the paper, in which the chairman, Mr. Troup, Messrs. Rawlings, E. L. Berry, Rashleigh Phipps, Frank Broadbent and others took part. One speaker questioned the policy of advocating tantalum lamps for all purposes, as in many cases they were now being used to replace ordinary 8-C.P. carbon filament lamps, with the result that instead of a reduction in the consumption of electricity, the cost was raised, and people were consequently dissatisfied.

Royal Society of Arts.—On Wednesday, April 8th, at 8 p.m., Sir William H. Preece, K.C.B., F.R.S., will deliver a lecture on "Technical Education in America."

The Faraday Society.—We learn that in consequence of the illness of Sir Oliver Lodge, the delivery of his presidential address, arranged for Tuesday last, had to be postponed until further notice.

Institution of Civil Engineers.—The annual dinner was held on 20th inst., the president, Sir William Matthews, in the chair.

Junior Institution of Engineers.—Sir William Huggins, K.C.B., O.M., D.C.L., LL.D., F.R.S., has been elected a vice-president of the Junior Institution of Engineers, in succession to the late Lord Kelvin; Sir Archibald Geikie, K.C.B., F.R.S., and Prof. J. J. Thomson, F.R.S., have also been elected. The first Local Section in connection with the Institution, now numbering over 1,000 members, has been established at Birmingham, with Mr. F. S. Pilling as chairman, and Mr. R. B. A. Ellis, of 67, Wordsworth Road, Small Heath, Birmingham, as hon. secretary.

North-East Coast Institution of Engineers and Shipbuilders.—On Friday last Prof. R. L. Weighton read a paper on "Piston Speed and Steam Engine Economy," based upon the results of tests made on the experimental engines in the Engineering Laboratory of the Armstrong College. His conclusions were that, for reciprocating steam engines, when only the piston speed is varied, there is a certain speed at which the maximum power is attained, and a speed, not necessarily the same, at which the maximum economy of steam used per B.H.P.-hour is reached. The latter piston speed was found in the case of the experimental engines to be 441 ft. per minute (quadruple expansion), and 447 ft. (triple expansion), the corresponding mechanical efficiencies being ·856 and ·87. An increase in the mechanical efficiency tends to raise the maximum-economy speed.

**Public Departments and Men of Science.**—In the House of Lords on Wednesday last week, Earl Cawdor, in a speech on the Navy Estimates, paid a tribute to the late Lord Kelvin, and made certain other remarks interesting to scientific men, who hold that in many matters the Government and public officials would do well to be guided by the opinions and special knowledge of scientific and technically-trained men of experience. We make the following excerpt from the *Times* report of 20th inst.:—"There are one or two changes that have taken place within the last year to which I wish to refer. . . . . Your lordships will remember a most interesting debate upon some questions which arose out of a scheme of the London County Council as to their electric generating station in the neighbourhood of Greenwich Hospital. I am glad to hear that the difficulties which appeared likely to arise have been, in the view of the Board of Admiralty, successfully and satisfactorily overcome. I remember that interesting debate, and I do not think that any of your lordships will easily forget two or three of the speeches that were then delivered. One was from a noble lord, whose absence we all regret, and whose loss we all mourn—I mean Lord Kelvin. Another speech came from Lord Crawford, and both speeches, I am afraid, produced this result on me, that they taught me how very little I knew of subjects which occupied the attention and exercised the brains of some of the ablest men in the country. These are things we remember with pleasure, and if the speeches of these noble lords on that day did nothing but bring about the result which was subsequently arrived at, I am sure that their efforts were not made in vain."

**Dinner.**—The annual dinner of the Croydon Electricity Works department staff was held at the Greyhound last Saturday evening, Mr. A. C. Cramb, the engineer-in-chief, presiding.

**For Sale.**—The Croydon Council is offering scrap trolley wire and overhead line fittings for sale, as will be seen from a notice among our advertisements to-day.

**Appointment Vacant.**—Third engineer-in-charge for Ilford (£90).

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

**Central Station Officials.**—On 16th inst. a presentation was made to Mr. S. T. Allen, who has held the appointment of deputy-electrical engineer at Plymouth for seven years, on behalf of the whole of the staff and men at the electricity works. Mr. Allen is leaving Plymouth to take up the appointment of City electrical engineer at Carlisle. The presentation took the form of a silver cake dish. Mr. Allen was also the recipient of a silver ink stand, presented to him by several of the leading electrical contractors in Plymouth.

Mr. F. Thompson has resigned his position as mains superintendent to the Erith U.D.C. Electricity Department, having entered into partnership with Mr. J. S. Enright, of 68, Lincoln's Inn Fields.

Mr. F. B. Hirst, of Partick, has been appointed shift engineer to the Smithfield Markets Electric Supply Co., Ltd., and Mr. G. B. Mitchell has resigned his position as senior shift engineer to the same company on account of ill-health.

The Stoke Newington B.C. has increased the salary of the electrical superintendent, Mr. S. Hann, from £150 to £175 per year and the salaries of Messrs. L. Andrew and H. Large, assistants, have also been advanced.

Out of 182 applicants, Mr. Webber, of Hastings, has been selected for the post of assistant electrical engineer at Sunderland, at a salary of £155 per annum, rising to £200.

Mr. C. C. Butler, the first assistant in the Willesden Electricity Department, has been promoted from the second to first-class division at a salary of £160, rising by annual increments of £10 to a maximum of £200. The salary of Mr. L. T. Bickell, mains superintendent, has also been increased, and will rise by annual increments to a maximum of £134.

Mr. F. E. Woolfenden, of Chesterfield Corporation Electricity Works, has been appointed shift engineer at the Crewe station. He was presented by Mr. R. L. Acland, on behalf of the staff, with a case of drawing instruments, slide rule, &c.

**General.**—On resigning the post of works manager to Messrs. W. T. Garnett's Cable Co., Bradford, Mr. Stork has been presented by the employés with a dressing case.

According to the *Times*, in commemoration of the twenty-first anniversary of the appointment of Sir William Ramsay to the Chair of Chemistry at University College, the professors entertained him at dinner on the 19th inst.

Mr. Harry J. Booker, formerly with Messrs. D. Santoni and Co., Ltd., has been appointed engineer in charge of the arc lamp and engineering department of Messrs. J. & H. Grevener, of Eldon Street House, E.C.

**Obituary.**—The *Birmingham Daily Post* announces the death of Mr. H. Baker, for many years superintendent of the telegraph department of the Birmingham Post Office. He served under the Electric and International Telegraph Co., prior to that company's business being taken over by the Government in 1870. Mr. Baker retired some fourteen years ago.

Sir Auckland Colvin, K.C.S.I., whose death was announced on Wednesday, was chairman of the Oriental Telephone and Electric Co., Ltd., and of the Telephone Co. of Egypt, Ltd.

## NEW COMPANIES REGISTERED.

**Electrolytic Co. (Spain and Portugal), Ltd.** (97,277).—This company was registered on March 19th, with a capital of £255,000 in 250,000 ordinary shares of £1 each and 100,000 founders' shares of 1s. each, to acquire interests in any invention relating to the production, treatment, application and use, by electrolysis or otherwise, of minerals and mineral substances, in particular to acquire the patents protecting the electrolytic process of L. M. Lafontaine in Spain and Portugal, to develop and turn to account the same, and to take over any mines, mining rights and lands in Spain, Portugal, or elsewhere. The first subscribers (each with one ordinary share) are:—J. Wilkins, Broad Street House, E.C., accountant; F. Mitchner (?), 12, Hatton Wall, E.C., agent; R. Smith, 18, Albany Road, Wimbledon, engineer; F. S. Gee, 12, Hatton Wall, E.C., engineer; J. Longworth, 41, Kyrle Road, Clapham Common, S.W., electrical engineer; E. A. Chevalme, 38, Holborn Viaduct, E.C., gentleman; and S. Billat, 38, Holborn Viaduct, E.C., gentleman. No initial public issue; the number of directors is not to be less than three or more than seven; the subscribers are to appoint the first, subject to the right of the Société Frangaise Electrolytique to nominate two; qualification, 100 ordinary or founders' shares; remuneration as fixed by the company.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**La Capital Traction and Electric Co., Buenos Ayres, Ltd.** (62,311).—A trust deed dated November 10th, 1907 (supplemental to an unregistered trust deed dated December 21st, 1900) for increasing an issue of debentures from £600,000 to £800,000, pursuant to resolutions of August 8th, 1906, and March 5th, 1907, and substituting not less than 16,000 preference and 18,000 ordinary shares of £5 each in the Buenos Ayres Grand National Tramways Co., Ltd., for the shares, securities and notes of the Cordoba Light and Power Co., of Maine, charged by the original trust deed, has been registered. Trustees: W. Trotter, Basildon House, Moorgate Street, E.C.; and R. Fleming, 2, Princes Street, E.C.

**British "Ever-Ready" Electrical Co., Ltd.** (71,891).—This company's annual return was filed on January 2nd, when the entire capital of £3,000 in £1 shares had been taken up and paid for in full. Mortgages and charges: £7,500.

**Sun Electrical Co., Ltd.** (63,261).—This company's annual return was filed on January 9th, when 13,764 preference and 5,400 ordinary shares had been taken up out of a nominal capital of £45,400 in 20,000 preference and 25,400 ordinary shares of £1 each. £19,164 has been paid. Mortgages and charges: £5,500.

**General Electrolytic Parent Co., Ltd.** (39,358).—This company's annual return was filed on January 8th, when 28,608 shares had been taken up out of a nominal capital of £30,000 in £1 shares. £10,608 has been received and £18,000 is considered as paid. Mortgages and charges: Nil.

**Chesham Electric Light and Power Co., Ltd.** (90,833).—Particulars of £10,000 debentures created by resolution of January 27th, 1908, have been filed pursuant to Section 14 (4) of the Companies' Act, 1900. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Coatbridge and Airdrie Electric Supply Co., Ltd.** (89,178).—A charge dated February 6th, 1908, to secure £3,500, has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital and the Coatbridge and Airdrie undertakings. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, E.C.

**Electrolytic Alkali Co., Ltd.** (Middlewich), (64,360).—Issue on January 27th of £350 4½ per cent. first mortgage debentures, part of series created July 9th, 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool. Previously issued of same series: £34,500.

**Vera Cruz Electric Light, Power and Traction, Ltd.** (89,686).—A trust deed dated January 7th, to secure £300,000 debentures, was registered on February 17th, 1908, pursuant to Order of Court. Property charged: Concessions, lands and other immoveable property in Mexico, and the company's other assets, present and future, including uncalled capital. Trustees: Sir Weetman D. Pearson, M.P., 16, Carlton House Terrace, London; and Hon. A. W. C. O. Murray, M.P. ("Master of Elibank"), Juniper Bank, Walkerburn.

**Liverpool Electric Cable Co., Ltd.** (71,099).—A memorandum of satisfaction to the extent of £500, of a debenture dated December 9th, 1904, securing not more than £6,000, has been filed.

**Bath and District Light Railway Co., Ltd.** (76,989.)—This company's annual return was filed on January 23rd, when 11,270 shares had been taken up out of a nominal capital of £225,000 in £1 shares. £11,270 has been received. Mortgages and charges: Nil.

**Marconi International Marine Communication Co., Ltd.** (65,759).—This company's annual return, made up to December 31st, was filed on February 11th. 204,056 shares have been taken up out of a nominal capital of £350,000 in £1 shares. £99,056 has been received, and £105,000 is considered as paid. Mortgages and charges: £25,000.

**Electrical Fittings Co., Ltd.** (96,508).—A debenture dated January 31st, 1908, to secure £6,000, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holders: Samuel Heath & Sons, Ltd., Cobden Works, Leopold Street, Birmingham.

**Kramos, Ltd.** (Electrical Engineers, Bath). (82,859).—Issue on February 10th of £1,100 6 per cent. debentures, part of series created February 23nd, 1906, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,400.

**United Electric Car Co., Ltd.** (57,082).—This company's annual return, made up to October 3rd last, was filed on February 5th. 150,000 ordinary and 100,000 preference shares have been taken up out of a nominal capital of £300,000 in 150,000 ordinary and 150,000 preference shares of £1 each. £250,000 has been received. Mortgages and charges: £50,000.

**Empire Electric Light and Power Co., Ltd.** (In liquidation). (75,545).—A memorandum of satisfaction in full of mortgage debentures dated October 12th, 1904, and March 1st and June 27th, 1906, securing £5,500, £6,200 and £1,100 respectively has been filed.

**Barnsley and District Electric Traction Co., Ltd.** (72,962).—An acknowledgment of indebtedness under seal, dated January 30th, 1908, creating a further £1,000 debenture stock (supplemental to a trust deed dated April 8th, 1903, securing £20,000 debenture stock), charged on the light railway undertaking and other property of the company, has been registered. Trustees: Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

**Gent & Co., Ltd.** (electricians, Nottingham and Leicester) (78,797).—A third mortgage debenture dated February 21st, 1908, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital, has been registered. Holders: People's Bank, Ltd., Bentinck Buildings, Wheeler Gate, Nottingham.

**Guildford Electricity Supply Co., Ltd.** (36,725).—Re-issue on February 20th, of £500 5 per cent. debentures, part of series created November 21st, 1905, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £25,000.

**Halpin's Patent Thermal Storage, Ltd.** (73,347).—This company's annual return was filed on January 1st, when 10,705 shares had been taken up out of a nominal capital of £12,000 in £1 shares. £1 per share has been called up on 4,705, resulting in the receipt of £4,315. £390 remains in arrears. £6,000 is considered as paid on 6,000. Mortgages and charges: Nil.

**Drummond Co., Ltd.** (59,372).—This company's annual return was filed on January 23rd, when 642 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £641 has been received, and £7 remains in arrears. Mortgages and charges: Nil.

**Van Raden & Co., Ltd.** (78,383).—This company's annual return was filed on January 31st, when 6,754 shares had been taken up out of a nominal capital of £10,000 in £1 shares. £4,654 has been received, and £2,100 is considered as paid. Mortgages and charges: £2,750.

**South American Development and Construction Syndicate, Ltd.** (89,791).—This company's annual return was filed on January 21st, when 10,000 shares had been taken up out of a nominal capital of £20,000 in £1 shares. 1s. per share has been called up, resulting in the receipt of £500. Mortgages and charges: Nil.

**Lytham Electric Light and Power Co., Ltd.** (89,766).—This company's annual return was filed on January 1st, when 5,051 shares had been taken up out of a nominal capital of £20,000 in £1 shares. 1s. per share has been called up, resulting in the receipt of £252 11s. Mortgages and charges: Nil.

**Delhi Electric Tramways and Lighting Co., Ltd.** (88,758).—Issue on February 24th of £23,200 5 per cent. debentures, part of series created January 3rd, 1908, to secure £50,000. Property charged: Benefit of Delhi Municipality Electric Licence, 1905, and Delhi (Municipality) Electric Tramway Order, 1906, the company's interests in certain land and buildings in Circular Road, Delhi, the tramway line and distribution system and the company's undertaking and general assets, present and future, except uncalled capital. Trustees: R. C. Pearman, 21, Old Buildings, Lincoln's Inn, W.C.; and J. Greig, 18, Belsize Park Gardens, Hampstead, N.W. Previously issued of same series £100.

**Provincial Tramways Co., Ltd.** (6,445).—A memorandum of satisfaction in full of debentures created May 27th, 1904, nominally securing £125,000, of which only £121,500 were issued, has been filed.

**Chipping Norton Electric Light and Power Co., Ltd.** (96,082).—Issue on February 20th of £1,000 6 per cent. debentures, part of series created same date to secure £4,000 charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

## CITY NOTES.

### Mersey Railway Co.

The directors report that during the half-year ended December 31st, 1907, the train mileage run was 416,189 miles, as compared with 416,555 during the corresponding six months of 1906. The number of passengers conveyed was 5,604,295, as against 5,271,524 in 1906, exclusive of season ticket holders. The total receipts from all sources were £51,027, as compared with £47,359 in 1906. The working expenses, exclusive of the charges for pumping, ventilation and lifts, were £33,205, equal to 65·07 per cent., as against £31,963, equal to 67·49 for 1906. These charges for pumping, ventilation and hydraulic lifts for the past half-year amounted to £4,103, equal to 8·04 per cent., as compared with £3,921, or at the rate of 8·28 per cent., for 1906.

### Deutsch-Atlantische Telegraphengesellschaft.

The report of the directors for 1907, which will be presented at the meeting to be held at Cologne on April 11th, states that the Atlantic traffic further increased during the year, and the Vigo traffic also showed a perceptible advance, so that the limit of the carrying capacity of the Emden-Vigo cable has almost been attained. No interruptions in the Atlantic cables occurred in the year, but the Vigo cable was inadvertently cut in November by a cable ship which was executing repairs to a neighbouring cable. The loss of traffic was inconsiderable, and the getting ready of a ship, which, however, was not put in operation, only occasioned comparatively small expense. The North German Marine Cable Works Co., in which the company is interested to the extent o £150,000, will not distribute any dividend for 1907. It is proposed to write off 2 per cent. on the buildings account, the amount of which ha

been increased by the establishment of a cable tank at Vigo; 5 per cent. off the cable stocks' accounts, and 10 per cent. off the apparatus account, as in previous years. The capital account remains unchanged, but further drawings have reduced the bonds by £11,400. The reserve funds stand at £77,000, the cable redemption funds at £164,887, the maintenance account for No. 2 cable at £21,669, and the officials' pension and aid fund at £10,000. The working results in the past two years have been as follows:—

| | 1907. | 1906. |
|---|---|---|
| Ordinary share capital ... | £1,200,000 | £1,200,000 |
| Bond capital ... ... ... | 967,150 | 978,500 |
| Net profits ... ... ... | 131,010 | 139,055 |
| Balance available, including the carry forward... ... | 155,902 | 162,993 |
| Dividend, per cent. ... ... | 7 | 7 |

During the year the working expenses increased, this being principally due to the larger volume of traffic. The amount paid in taxes was higher than in the preceding year; the value of the securities purchased before 1907 experienced a depreciation; and the interest account was credited with £7,500 as the dividend received from the North German Marine Cable Co. for 1906, this being £15,000 less than the sum derived from the same source for 1905. The net profits given above include a contribution of £18,476 from the German Imperial Post Office towards the working expenses, as contrasted with £16,976 in 1906. As the expenses for cable repairs were only slight, it is considered advisable to place £35,000 to the special reserve fund in order to be able to meet any subsequent large repairs partly out of the interest from this fund. It is proposed to allocate £6,550 to the ordinary reserve fund and £3,750 to the pension fund for officials, and to appropriate £2,073 for the remuneration of the board of supervision, and £3,325 for the directors and bonuses to officials, the balance of £21,203 being carried forward to the current year.

## City of London Electric Lighting Co., Ltd.

The ordinary general meeting of the shareholders of this company was held on Wednesday, March 18th, at Salisbury House, London Wall, Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, March 13th, page 452), said it would be seen that the total capital expenditure of the company had amounted to £2,268,106, and that prior to December 31st, 1906, they had already written £129,077 off that amount. They proposed a further writing off of £38,958 in respect of buildings, plant and other works dismantled during the past year. They proposed also to apply a further £8,400 in reduction of other items, which would bring the total amount written off to £176,435, leaving their net expenditure on capital account at £2,091,671, as compared with £2,051,960 last year, a net addition during the year of £39,710. In addition, they had reserve funds £221,226; £55,921 first debenture stock premium reserve fund; standing reserve for doubtful debts £3,000, and they proposed to carry forward to 1908 £20,473, showing that they had reserves of £300,601, after writing £176,435 off capital. He thought they would agree that that was a very sound position for their capital account and reserve funds, and was placing the company on an extremely sound financial basis. Altogether this year they were placing out of revenue a sum amounting to £53,000 in strengthening their reserves in various ways. The ordinary stock amounted to £700,000, so it would be seen that they were placing an amount equal to about 7½ per cent. of their ordinary stock to increasing their reserves. They were proposing to pay the usual dividend of 6 per cent. They had supplied all their capital requirements out of revenue for some years past, instead of making any fresh issues of capital. The increase in their gross receipts for the year has amounted to £18,092, but in view of the fact that in 1906 they received £5,518 for sales of current to the L.C.C. tramways, the actual increase in the company's own business had been £23,610, which he thought they would agree was very satisfactory. Their net revenue showed an increase of £12,775. The increased expenses had been: coal, £6,510, of which £3,298 was due to the increased cost; wages, £649; rent, rates and taxes, £382; management expenses, £168, making a total increase of £7,891. On the other hand, they had effected economies amounting to £2,574, making the net increase in expenses £5,317. They were not going to pay an increased dividend, but instead to place the company in a sounder financial position—a course which he felt sure would commend itself to the shareholders. They had expended £1,114 on experimental street lighting in the City, and there had been a saving of £1,612 in Parliamentary expenses, and the result was that they carried forward £147 less than the year before. With regard to the lamp connections they had now got well over the million lamps, and their connections were a record. They showed an equivalent of 110,160 lamps connected during the year, and it was an interesting fact that two-thirds of that increase represented connections either for power or heating purposes, so it would be seen that they were not neglecting that class of business, and as far as the current year was concerned they had received applications for a further 12,257 lamps. In units sold they had increased by a little over 2 millions, and if they made allowance for the units sold in 1906 to the L.C.C., the increase in units sold to their own customers was 2,631,756, representing an increase of 12½ per cent. He was glad to say that in spite of the higher cost of coal, the efforts of their engineering staff had resulted in a further reduction in their works costs of ·02d per unit. It would not have been remarkable had the costs remained stationary, and the fact that they had been reduced was, he thought, high testimony to the skill and efficiency with which their generating station had been managed, and they were greatly indebted to Mr. Bailey and the able staff who served under him. With regard to Parliamentary matters, in past years that had been their chief anxiety. All they had been asking was to be let alone to carry on their business in the best possible way and to do their best for their customers, but for some years past they had had constant difficulties to contend with through various parties coming in with fresh schemes. He was glad to say that the position now was decidedly more satisfactory than it had been for the past two or three years. It was said, even by those who ought to know better, that there were thousands of people in London waiting for a cheap supply of electric power, and the expression was sometimes used that "it was a scandal that London should still be waiting for a cheap supply of electricity." That statement was altogether fallacious, in fact, it was a pure myth. Their own company sold last year over 6,000,000 units for power and heating purposes, while the County of London Co. last year sold more than half its total out-put for power purposes. The fact was that the present London companies were both ready and willing to supply cheap electricity for power purposes to all who required it. From a return issued by the Board of Trade last December, he found that during the year ended December 31st, 1906, no fewer than 66,287,518 units were sold by the companies and the local authorities in London for power and heating purposes, and the average price obtained for that power was 1·386d., just a fraction over 1½d. per unit. If they had the figures up to the end of December, 1907, he believed that they would show a considerable increase, for the output that year of the County of London Co. for power purposes alone, was 30 per cent. ahead of that of 1906, and in the case of their own company, the increase was 20 per cent. The return for 1906 showed that 28,281,320 units were supplied by local authorities for power purposes, as compared with 38,006,198 units sold by companies. There was, therefore, no demand for any new bulk supply, and the existing generating stations of the companies and the local authorities were quite capable of doing anything further which might be needed to co-ordinate and improve the supply of electric power for London. The question of the supply of electric power should not be made one of party politics, but should be treated as a purely business proposition, and he was glad to see that Mr. Lloyd-George, speaking as President of the Board of Trade in the House of Commons the previous night, had adopted that view, and had suggested a conference. He (Mr. Braithwaite) felt that the Board of Trade would be doing a great service to London if they were to take the initiative and call a conference of all parties interested.

Mr. F. W. Reynolds seconded the motion, and the report was adopted.

Subsequently the meeting passed a resolution approving the Joint Companies' Bill to be promoted in Parliament.

**Liverpool District Lighting Co., Ltd.**—The report for 1907 states that the demand for electricity still shows a satisfactory rate of increase, the units sold for the year being 354,750, an increase of 13,325. Owing, however, to the increased cost of fuel and other causes, the resulting profit has not increased *pro rata*. In the balance-sheet the value of "free wired" installations is less than at the corresponding period of last year. This is accounted for by the fact that the directors have decided not to carry out any more of this work, as practically all the houses now being built in the company's area are wired for electric light during construction. Two of the old installations have been purchased outright and one written off. The gross profits for the year, together with the amount brought forward, after payment of dividend, leaves a profit of £2,315 available for distribution. £833 has been set aside for depreciation, leaving £1,461. It is proposed to declare a further dividend at the rate of 5 per cent. per annum for the half-year ended December, 1907.

**Madras Electric Tramways (1904), Ltd.**—The report for 1907 showed a gross profit of £9,248, plus £176 brought forward, making £9,424. £1,500 is transferred to the depreciation and renewal fund, a dividend of 4½ per cent. per annum is proposed on the preferred ordinary shares for the six months ended December 31st, 1907, leaving £221 to be carried forward. The traffic on the extensions has steadily developed, but the profit on running, though showing an increase, has suffered by the abnormally high price of fuel. Sir Henry C. Mance and Sir Irving Courtenay have resigned their seats at the board. Mr. Thomas Edward Ivens has been elected to fill one of the vacancies. The meeting was to be held yesterday.

**British Insulated and Helsby Cables, Ltd.**—The annual meeting was held at Liverpool on Monday, Mr. E. K. Muspratt presiding. From a report of the proceedings which has been supplied to the financial Press, we gather that the report was adopted unanimously.

**Gateshead and District Tramways Co., Ltd.**—The report for 1907 states that the total revenue for the year amounted to £54,309, as against £52,622 in 1906. After deducting all expenses chargeable to revenue, including repairs and maintenance and interest on mortgages, there is available for appropriation £23,756. £3,500 is transferred to the credit of depreciation and renewals account, making it £15,392. Dividends of 5 per cent. and 6 per cent. respectively on the two classes of preference shares are paid, and one of 7 per cent. per annum is proposed on the ordinary shares carrying forward £1,738. The directors consider that the year's result is satisfactory in view of the bad weather and the depression in the shipbuilding trade.

## The Direct Spanish Telegraph Co., Ltd.

The meeting of this company was held on March 19th, at Electra House, Finsbury Pavement. The Marquis of Tweeddale presided, and in moving the adoption of the report (see Electrical Review, March 13th, p. 451), he said that the receipts showed an increase of £202, which they might consider satisfactory, seeing that in 1906 the traffic carried was £4,952 in excess of that of the previous twelve months. Extra press work was dealt with in 1907, owing to a number of events of international importance. The increase in the purely commercial traffic, which dated from 1906, might fairly be ascribed to the improved relations that now existed between this country and Spain, and which commenced at the time of the marriage of King Alfonso. The working expenses showed a very small increase, and the amount spent on maintenance and repairs had decreased by nearly £300. During the year they had not been free from cable interruptions, and the cost of repairs of the Bilbao cable had been £3,294, which had been charged to the revenue account. The reserve fund, which on January 1st last stood at £48,360, had decreased during the year by £4,120; but £10,000 had been applied during 1907 towards redeeming the second mortgage debenture bonds, which reduced that issue to £8,000. He was glad to say that the depreciation in the company's securities, which a short time ago amounted to 16 per cent., had now been reduced to 14 per cent.

Sir J. Denison Pender seconded the motion, and the report was adopted.

## London United Tramways, Ltd.

The directors' report for 1907 states that the operation of the company's undertaking during that period resulted in gross receipts amounting to £345,570, and the working and general expenses, maintenance and repairs to £214,672, leaving, with the balance brought forward from last account, a net revenue of £131,747. After payment of interest on debenture stock and loans and the dividend on the 5 per cent. preference shares for the year, and providing for income-tax, there is a balance of £10,260 10s. 10d. An interim dividend at the rate of 2 per cent. per annum, less income-tax, amounting to £8,973, was paid in August last, leaving £1,287, which the directors propose to carry forward. The gross receipts show an increase of £17,674, and the total number of passengers carried was 58,725,980, an increase of 3,370,699. The managing director's report states that the rolling stock, plant, &c., have been efficiently maintained out of revenue, but the directors regret that the profits have not permitted of any appropriation to the renewal fund, which it is their desire to augment year by year. The section of the company's system in Surrey, from Raynes Park to Wimbledon and Tooting, about 6¼ miles of tramway, was completed and opened for public traffic in June last. The tramway mileage now in operation consists of 55¼ miles. The company's powers in respect of certain uncompleted lines expire in August next, and application is at present before Parliament for a further extension of time and also for powers to lay a line across Kew Bridge, forming a connection between the company's main lines and Richmond. The L.C.C. connection with the Wimbledon lines at Tooting has not yet been effected, and the question of through running over the respective systems still remains the subject of negotiation. It is with regret that the directors have to record the fact that owing to the exceptionally cold and wet summer season, receipts for the second half of the year's working have proved to be disappointing. Mr. James R. Chapman having accepted a seat on the board, now offers himself for re-election.

## North Metropolitan Electrical Power Distribution Co., Ltd.

The meeting of this company was held on March 19th at 101, Finsbury Pavement. Mr. James Devonshire presided, and in moving the adoption of the report, said they would observe that the Barnet, Enfield and Hertford undertakings were now in improved working order, and the St. Albans undertaking had been tackled; mains had been laid, and it was expected that a supply would be commenced during the summer months. They had also commenced operations with the Wembley Electric Lighting Order, which was originally granted to the local authority, but which, with the consent of the Board of Trade, their company took over. They hoped to lay mains in Wembley before very long. The revenue account showed a satisfactory increase, and they looked forward to further expansion this year.

Mr. George Offor seconded the motion, and the report was adopted.

Subsequently an extraordinary general meeting was held to consider a resolution authorising an increase in the capital of the company.

The Chairman explained that the present authorised capital of the company was £50,000, of which £47,000 had been issued and paid up. They proposed to increase the capital to £100,000 by the issue of 5,000 £10 shares. They had been increasing the work of the company, and they therefore required additional capital to complete and improve the various undertakings which they controlled. They would see that the increased capital proposed was really necessary, and perhaps by this time next year they would have spent the difference between the present paid-up issued capital and what they proposed to increase it to.

Mr. Offor seconded the resolution, and it was carried.

## Folkestone Electricity Supply Co., Ltd.

At the annual meeting of shareholders held on Friday last, Alderman Spurgen, the chairman, in moving the adoption of the report (see Electrical Review, March 20th, page 499), said that the shareholders met under very happy circumstances, because they would see that the capital increase had only been £6,341, as compared with £10,304 and £13,571 in the two preceding years, while they had done considerably more business. The number of new consumers had not increased by quite so many as in the previous year, but the consumption of energy by them was very satisfactory. There being no prospect of any new large businesses, they had to look to private residences for the increased business. Their total of 8-c.p. lamps was 96,300, and there had been an increase in the gross receipts of £2,433, as against £1,345 in the preceding year, and £1,028 in the year before that; the increased cost of working was not exceptional, amounting to £736, of which £246 was for interest on debentures. The increased cost of coal had affected them to the extent of £491, and it would have been higher had there not been running contracts. They had been very fortunate in the matter of the absence of breakdowns, and in this they had saved £175. The net surplus profit was £1,457 more than in the preceding year. They had increased the reserve fund to £2,350, and business was altogether in a very healthy state. He moved that a dividend of 7 per cent. for the second half-year be paid (equal to 5½ per cent. for the year).

The report was adopted, and votes of thanks were passed to the directors and to the manager (Mr. Hesketh), and the staff.

## Bournemouth and Poole Electricity Supply Co., Ltd.

The meeting of this company was held at Moorgate Court, E.C., on Thursday last week, Mr. A. H. Sanderson presiding.

In moving the adoption of the report (see Electrical Review, March 20th, page 500), the Chairman said he trusted that the accounts, speaking generally, would give satisfaction. It had been for many years past a pleasant and agreeable duty to preside at the annual meetings of the company, for each year he had had to report progress. Although there had been some adverse circumstances during the past year, he thought the accounts would give full satisfaction, for they were able to record increases in every department, and were able to recommend a dividend of 7 per cent. on the ordinary shares for the fourth year in succession. The share capital remained the same as in 1906, with the exception that certain calls then outstanding, amounting to £333, had been paid. The debenture issue was also the same, viz., £150,000. The sundry creditors on open accounts, bills payable and loans amounted to £31,731. The reserve from premium account was less by £1,500, carried to depreciation reserve account, leaving a balance of £1,209. The leasehold and special redemption account had been increased by a further £1,423 taken from revenue on the lines of their usual practice, and this amounted to £8,274. The reserve for depreciation amounted to £18,887. As to the assets on the other side the sum of £421,198 had been expended up to December 31st on capital account, and of this sum £31,030 was expended in the past year. The chief expenditure was on mains extensions, buildings and machinery, and the extension of mains they looked upon as the most remunerative portion of their capital expenditure. They looked forward to the time when the expenditure on buildings and machinery would practically come to an end, but in a scattered district such as they served there were acres yet to develop, and they would have an expenditure on mains for some years to come. The amount expended on machinery, &c., would bring about a most valuable improvement at their lighting station, and would result in considerable economies in the future. The sum invested in the Richmond Co. was increased by a further £5,000 loan to the company. Sundry debtors amounted to £29,931, which was largely in respect of sums due from consumers for current supplied at the end of the December quarter. The greater portion of this had already been collected, and the remainder was quite good. The suspense account of £2,175 was in regard to machinery written off amounting to over £4,000. Half of that they had written off in the depreciation account, and the balance they proposed writing off next year. The item of provisional orders secured £2,002 related to Swanage, Wimborne and Canterbury and others which they regarded as good assets with distinctly good possibilities, although the best moment for dealing with these matters had not, in their opinion, quite arrived at the present time. Turning to the reserve account it would be seen that the progress made was quite satisfactory. There was an increase of £4,632 in the total receipts, of which no less than £4,503 was in respect of sale of current and meter rentals, which was the backbone of their business. The item of interest and dividends, which showed an increase of £412, was in respect of the additional return on their investment in the Richmond Co. The total revenue would have been much better but for the reduction made last year in the rate charged for current to the Bournemouth municipal tramways. Under the contract with the Corporation provision was made for a revision of rates every five years, and the first period for revision fell due last year, and this materially affected the accounts. It was also the fact that the quantity of current taken by the tramways last year did not come up to their expectations, although he was glad to say that that taken lately was more satisfactory. The result was also achieved in spite of dear coal, and growing gas competition. On the debit side, coal, oil, water, &c., had increased by £988, due principally to coal. There had been an increase of 251,057 in the units sold, which meant a corresponding increase in the cost of generation. Repairs to buildings and plant had

increased by £833, and wages and salaries had advanced by £187. Rates and taxes showed an increase of £700, and as theirs was a growing business, he was afraid that that item would continue to increase year by year. Their undertaking in Poole and Branscombe was reassessed last year; they appealed, and succeeded in coming to a fairly satisfactory settlement. In the net revenue account, the principal items were the leasehold and special redemption funds and interest amounting to £1,423 12s., and the reserve for depreciation £3,000. Taking those two items it would be seen they had written off £4,423 12s., which they considered quite adequate, bearing in mind the position and prospects of the company. Turning to the general progress of the business as indicated by the number of lamps applied for and the units sold, they would agree that it was quite satisfactory. The lamps applied for up to December 31st showed an increase of 23,130, while the increase in units sold was 251,037. To recapitulate in brief the main points, it would be observed that there was an increase of 10·3 per cent. in the receipts from the sale of current and meter rentals, an increase of 9·2 per cent. in the gross receipts, and an increase of 13·9 per cent. in the net revenue. They were placing £4,500 to reserve fund, partly out of revenue and partly out of premium account, and were writing out of revenue the further sum of £1,423 in respect of special redemption account. Since January 1st, 1908, the units sold were equal to an increase of 17 per cent. over the corresponding period of last year, and the lamps applied for during the same period amounted to 3,212. The number of consumers had increased by 71, making at the present time a grand total for consumers of 4,042. In the past year they had done their utmost to bring the business prominently before the public, and had carried out extensive improvements at their offices in Bournemouth. They had put in a most artistic front, and were exhibiting apparatus and appliances for lighting and cooking, which would doubtless attract consumers in the future. They were paying 7 per cent. on the ordinary shares, notwithstanding the fact that they were paying a much larger sum to the preference shareholders this year owing to the recent issue of preference shares. In conclusion, the Chairman mentioned that the Richmond Co. were promoting a Bill in Parliament for the construction of tramways from Hammersmith, through Barnes to Richmond. What the fate of that Bill would be he did not know, but if it was successful it would greatly strengthen the position of the Richmond Co., and not materially increase the value of the holding of the Bournemouth Co. in that undertaking.

Dr. J. A. Hosker seconded the motion, remarking that the company were supplying 33 per cent. of the houses in Bournemouth with electric light.

The report was adopted, and the directors were re-elected.

## North Metropolitan Electric Power Supply Co., Ltd.

Sir Ernest Spencer presided on Tuesday at the meeting held at 101, Finsbury Pavement.

In moving the adoption of the report (see Electrical Review, March 20th, page 499), the chairman said that the revenue had amounted to £59,373 for 1907 as compared with £44,191 for the previous year, an increase of £15,182. The revenue from the sale of energy was £58,748 as against £43,685, showing an advance of £15,063 which was equivalent to 35 per cent. There was an increase of £10,505 in the expenses which were for this year £36,252 as compared with £27,747. That increase was principally due to the advance in the price of coal, and the proposals which were now before the country indicated that there would be a still further increase, which would affect their dividend and those of companies similar to theirs. The number of units sold were 11,183,316 as against 7,999,367 which was an increase of 3,183,949 or equivalent to 40 per cent. increase. The reasons for that increase were the opening of new lines by the Metropolitan Electric Tramways, and the consequent demand for more electricity, the increased supply to the Willesden and Stoke Newington Councils respectively, and to power-users, the increased output by the Distribution Co. at Barnet, Hertford and Enfield, and the commencement of a supply under the Edmonton and Tottenham orders. Since the commencement of the year they had given a bulk supply to the Hendon Electric Supply Co., Ltd., and there was every indication that the satisfactory expansion of the company's business during the past year would be maintained. Their Act of 1907 received the Royal Assent on August 2nd of last year. He was pleased to say that they had had a very successful year, and there was every reason to believe that they would go on steadily progressing, and he hoped that they would continue to offer to them as satisfactory a report as the one now before them.

Mr. John Devonshire (managing director), in seconding the motion, said that there was no doubt that the increase in the price of coal had diminished their ordinary share dividend by 1 per cent. At the beginning of this year their coal merchants told them that they would have to pay 2s. 6d. more per ton for their coal, and that probably meant 2 per cent. of the ordinary dividend swallowed up. The Bill now before Parliament, if treated seriously, would affect them to a great extent. Coal was their life blood, as it represented about 75 per cent. of the total working expenses. The capital of the company was increased last year to enable them to deal with their largely increased business. He thought it would be interesting to the shareholders to know that since the company had seriously got to work, there had not been a single new generating station erected in the whole of their area for the purpose of giving a supply for light, power, or heating purposes. That was, of course, excluding generating stations which had been erected by railway companies for their own purposes—he referred to owners of electric lighting orders where new works had been erected, and where they had been fortunate in securing a supply to them. A very interesting instance was the Hendon Electric Lighting Co., who were owners of an Electric Lighting Order, and who were very largely interested in the manufacture of electrical machinery and plant, yet their advisers told the Hendon Co. that they could not possibly supply themselves with electricity generated in their own station as economically as what they could purchase it from that company. The result was that a contract had been signed for the whole tenure of their order, and they were at the present moment giving a supply with entire satisfaction. There had also been an increase in the number of units consumed by the Hendon Co., showing that more lamps were being connected. The company was in negotiation for the supply of energy to a flour mill, and he trusted that when he addressed them again a contract would have been signed for the supply.

The report was adopted.

## Traction and Power Securities Co., Ltd.

The directors report that the net revenue for the year 1907 amounts to £19,584, which, added to the sum of £3,242 brought forward, gives a sum of £22,827 to be dealt with. The directors have applied the sum of £3,000 to make good the depreciation shown in the company's quoted securities at the date of the balance-sheet, and have transferred a sum of £15,000 to the investment reserve fund. This leaves £4,827 to be carried forward. In regard to Mersey Railway, 4 per cent. new first perpetual debenture stock, and Clyde Valley Electrical Power Co. ordinary shares of £10 each, these securities, for which there is no market quotation, remain on the books at cost, and until their outcome is ascertained the directors make no re-valuation of them. Meanwhile the investment reserve fund stands at £65,000. During the past year the company has increased its holding in the Mersey Railway debenture stock by £19,297 in fulfilment of a contract previously entered into. The earnings of the railway continue to show a steady increase. The company has paid up further calls in respect of its holding in the Clyde Valley Electrical Power Co., the liabilty for unpaid calls being now reduced to £15,048. The directors have agreed to grant the Clyde Valley Electrical Power Co. a loan of up to £100,000, to enable it to extend its installation and system of distributing mains. Of this sum £29,684 had been advanced at the date of the balance-sheet.

The annual meeting was held on Thursday, March 19th, at 2, Norfolk Street, Strand. Mr. J. H. Lukach, in proposing the adoption of the above report, said that the year had been rather an uneventful one in the affairs of the company. No realisation of their investments had taken place, and no fresh business had been taken up, while the income from their investments showed a moderate increase over that of the previous year. The directors considered it inadvisable to recommend the payment of a dividend, and having regard to the fact that the principal investments were still in the stage of development, they had transferred £15,000 to the investment reserve fund, leaving £4,826 11s. 3d. to be carried forward. Touching upon the balance-sheet, the loan of £23,000 was in the nature of a temporary advance from their bankers, and against it they had deposited some of their Mersey Railway debentures as collateral security. It would be noticed that the investments showed an increase of £50,770 as compared with the 1906 balance-sheet, and the whole of that increase was accounted for by their holdings in the Mersey Railway debenture stock and the Clyde Valley Electrical Power Co. The loans against security showed an increase of £29,684, which was explained by their loan to the Clyde Valley Electrical Power Co., to which reference was made in the report. The previously exising loan of £49,152 to the Tramways Mécaniques des Environs de Paris had been repaid to them since the date of the balance-sheet, and that loan, with an additional £10,900, has been transferred to the Société Anonyme Westinghouse de Paris until June 6th, 1908. As regarded the item of £1,700, cash deposited in guarantee of contract, that referred to a contract of the British Westinghouse Co, the performance of which they had guaranteed. The parties required that a deposit of the amount in cash should be made with the London and County Banking Co,, and that they had done for a proper consideration. The deposit would be released to them upon the completion of the contract, which they expected would occur very shortly. The company's holding in the Mersey railway 4 per cent. first debenture stock had been increased by £18,297 and they had now fulfilled their agreement entered into at the time of their incorporation in 1901, to purchase £620,000 of that stock. The receipts of the railway continued to show a satisfactory increase. The guarantee arrangement under which they agreed to accept towards the interest on their debenture stock, only such proportion as was earned by the railway, terminated at the end of the present year. With regard to their investment in the Clyde Valley Electrical Power Co, he thought he might say that the position of this undertaking had made considerable improvement during the past year. The company was being well and intelligently managed under the able chairmanship of his colleague, Mr. Bonar Law, and the demands on the company's generating stations had now reached a point where the receipts were just about sufficient to balance both the power-house costs and the overhead charges of every kind, including administration. The directors of that company foresaw that additional capital of

£100,000 would be required to carry out extensions in the distributing mains, generating and sub-stations, which were deemed to be absolutely necessary, and they had agreed to find that amount against the Clyde Valley Co., undertaking to grant them a first charge upon the whole of their property and plant. The earnings were sufficient to pay them a satisfactory rate of interest on the loan. The issued capital of the company was £600,000, practically the whole of which had been paid up, and as there were no other loans or charges they considered their security was absolutely good. It was not anticipated that the whole of the £100,000 would be required at once, but they would be called upon to advance instalments on account over a period of probably two years.

Mr. H. A. Vernet seconded the motion, and the report was adopted.

## Metropolitan Electric Tramways, Ltd.

The directors' report for the year 1907 states that the total revenue amounted to £297,223, including £27,476, the balance of dividends received in 1906 from the North Metropolitan Tramways Co. and reserved from the previous account. The directors have decided to spread this balance over the period ending June, 1910, during which the company would have continued to receive dividends from the North Metropolitan Tramways Co. but for the surrender by that company of its lease of the L.C.C.'s Northern tramways. In pursuance of this policy £7,850 has been brought into the present account, and the balance, £19,626, has been reserved. The traffic receipts, which amounted to £244,200, show the satisfactory increase of £64,600 over the previous year. After deducting all expenses chargeable to revenue, including £10,500 for reconstruction and renewals, and writing down preliminary expenses and other items by £6,221, there remains a surplus of £49,574, making, with the £3,791, the balance brought forward from the last account, a total of £53,365. Of this the directors recommend that there be placed to a reserve fund £5,000, dividend on preference shares for the year (already paid), £25,000, dividend on 391,337 ordinary shares at the rate of 4½ per cent. per annum £17,610, carrying forward £5,755. The company have discharged the balance of their liability in respect of the 3½ per cent. debentures of the North Metropolitan Tramways Co., by the payment of £51,700.

At December, 1907, the issued capital was:—£500,000 in 5 per cent. cumulative preference shares of £1 each, fully paid; £391,337 in ordinary shares of £1 each, fully paid; £314,016 in deferred shares of £1 each, fully paid; £350,000 in 4½ per cent., and £76,200 in 3½ per cent. debenture stock. Since that date a further £173,800 4½ per cent. debenture stock has been issued. The mileage of lines in operation is 40 miles 6 furlongs.

The company are promoting a Bill this session to authorise, *inter alia*, the construction of a tramway in the Harrow Road, from the terminus of the existing line to the Edgware Road. The L.C.C. have given the company notice under Sec. 43 of the Tramways Act, 1870, of their intention to purchase so much of the existing Harrow Road tramway as is situate within the county of London. Negotiations are proceeding with the Council as to these matters.

The company have increased their holding in the North Metropolitan Electric Power Supply Co. to 40,000 shares of £10 each, of which 30,000 are fully paid and the balance £5 paid. The dividend to be received in respect of this investment for the past year amounts to £12,285, being at the rate of 4 per cent. per annum on the amount paid up on these shares.

The sale of electricity by the Power Supply Company in the past year shows an improvement of £15,063 (being an increase of 34 per cent.) over the previous year, the number of units sold exceeding 11,000,000.

The North Metropolitan Electric Power Supply Act, 1907, extends the powers of the company under their 1902 Act to give a supply of electricity for power purposes to most of the remaining portion of the area of supply (defined as the "special district"); authorises, under certain conditions, the giving of a supply for lighting purposes within the special district; extends the powers of the company under their Act of 1900 as to the transfer of undertakings of local authorities and others; authorises further methods of charge and the sale or hire of electrical fittings, and contains various financial clauses.

During the past year the Power Supply Company made arrangements for the issue of £126,500 5 per cent. mortgage debentures.

The company have joined the British Electrical Federation, formed by various electrical, traction and lighting companies for the purpose of co-operation and joint action in matters of common interest.

Traffic Summary.

| | 1906. | 1907. |
|---|---|---|
| Miles open (at December 31st) .. .. .. | 29·625 | 40·75 |
| Number of passengers carried .. .. .. | 36,318,774 | 48,242,404 |
| Number of car-miles run .. .. .. | 3,975,463 | 5,037,204 |
| Average receipts per car-mile .. .. .. | 10·84d. | 11·63d. |
| Average receipts per passenger .. .. .. | 1·18d. | 1·21d. |
| Number of cars in stock (at December 31st) .. | 190 | 187 |

**Anglo-Argentine Tramways Co., Ltd.**—The balance to the credit of the revenue account on December 31st, 1907, including £10,081 brought forward from 1906, and including the profits of the six months' working of the Buenos Ayres and Belgrano Electric Tramways system (after deduction of interest on the balance of unpaid purchase money), and allowing £65,000 for depreciation renewal funds (in addition to amounts expended on ordinary maintenance), amounts to £335,323. After transferring £4,200 to a sinking fund for the redemption of the preference shares, £4,000 to investment depreciation account, out of the balance available for dividend, the directors recommend the payment of a final dividend on the 320,000 second preference shares of 5s. per share (less income-tax), also a dividend on the 40,000 new ordinary shares at the rate of 8 per cent. per annum, carrying forward the sum of £16,735. The transfer registers for the second preference shares are closed from March 26th to April 9th inclusive.

**South London Electric Supply Corporation, Ltd. and Red.**—A dividend of 4 per cent. on the full ordinary shares is recommended for 1907 as against 3 per cent. for 1906.

**Ottawa Electric Co., Ltd.**—The annual meeting of the Ottawa Electric and Gas Companies and the Consolidated Light, Heat and Power Co. was held recently. The report was very satisfactory. The revenue from all sources in the Ottawa Electric Co, for the eight months of the fiscal year, aggregated $213,500, showing a large increase. The cost of management, maintenance, interest, &c., was $130,006. The surplus of revenue over expenditure for the eight months is $83,494, a material gain. The power released by the city taking over the street lighting contract has been utilised for other purposes. On capital account $45,319 was expended. Installations: new additions of 8,307 incandescents, 18 motors, 663 Nernst lamps distributed among 798 new customers. The balance from profit and loss and the eight months' surplus amounts to $94,735. From this two dividends on the basis of 5 per cent. have been paid, $50,000 has been added to the reserve fund, now totalling $500,000, and $9,267 remains to the credit of profit and loss.

**South Wales Electrical Power Distribution Co.**—The report for the year 1907, to be submitted at the meeting in Cardiff on 31st inst., states that since the meeting held in July, 1907, the new directors have administered the affairs of the company. The working arrangement with the Treforest Electrical Consumers' Co., Ltd., approved at the last general meeting, has been put in operation, and the working of the Treforest generating station and the area supplied from that station was taken over by the Treforest Company on September 1st, 1907. That company has already placed orders for about £26,000 for new and modern plant, which will materially reduce the cost of production. Negotiations are proceeding, and it is hoped will shortly be completed, for the formation of a similar consumers' company in the Cwmbran area to take over and work the Cwmbran generating station. The directors report that creditors in respect of the heavy liabilities appearing in the last balance-sheet have met the company in the most friendly manner by agreeing to accept preference shares in settlement of their claims, and liabilities for upwards of £78,000 have been settled in this way.

**Veritys, Ltd.**—The directors' report for the year ended January, 1908, shows that, after paying interest on the 5 and 6 per cent. preference shares, and placing nearly £6,000 to depreciation, reserve, doubtful debts, &c., a dividend at the rate of 5 per cent. per annum is paid on the ordinary shares, as in the previous year. The company's plant was fully maintained out of revenue. The year 1907 was a difficult one, inasmuch as it saw large fluctuations in prices of raw materials, while severe competition for manufactured articles was also experienced. The volume of business has again shown expansion; expenses have been practically stationary; part of the works has been rebuilt, giving greater manufacturing capacity, and these shops are full of orders.

**Robey & Co., Ltd.**—The profit for 1907 amounts to £34,142, and after writing off £8,538 for depreciation and other charges, there remains a balance of £24,393. A dividend of 7s. per share is to be paid, requiring £10,318, and there is devoted to writing off investments £3,340, and £3,316 is carried forward.

**Fairbairn Lawson Combe Barbour, Ltd.**—The dividend on the ordinary shares for 1907 is 7½ per cent. plus a bonus of 1 per cent. £30,000 is transferred to extension reserve, and £26,329 is carried forward.

**Prospectuses.**—*North Metropolitan Electric Power Supply Co.*—This company has this week been offering for subscription 300 debentures (5 per cent.) of £100 each at par.

The *Daily Mail* understands that the new issue of 100,000 London Electrobus shares will be made directly after Easter. The issue will consist of part of the ordinary shares remaining unissued.

*Bombay Electric Supply and Tramways Co., Ltd.*—An Indian newspaper recently to hand contains a brief prospectus, by which the Chartered Bank of India, &c. (on behalf of a syndicate), offered to the public locally 25,643 ordinary shares of £10 each.

**Okonite Co., Ltd.**—According to the *Financier*, the directors recommend a further dividend of 2 per cent. on both preference and ordinary shares, and an extra 2 per cent. on each class, making 10 per cent. for the year 1907.

**Melbourne Tramway and Omnibus Co., Ltd.**—A dividend has been declared for the quarter ending March 31st at the rate of 4½d. per share.

**Belgium.**—La Société des Tramways Electriques du Pays de Charleroi et Extensions, of Charleroi, reports a profit of £8,584 for the last financial year.

**Stock Exchange Notices.**—The Committee has been asked to appoint a special settling day in—

British Aluminium Co., Ltd.—20,000 ordinary shares of £5 each, fully paid, Nos. 40,001 to 60,000; and 20,000 7 per cent. cumulative preference shares of £5 each, fully paid, Nos. 40,001 to 60,000.

and to allow the following securities to be quoted in the Official List:—

Canadian General Electric Co., Ltd.—$2,000,000 cumulative preference stock in shares of $100 each.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended February 28th, 1908, were 298,976, compared with 271,037 units in the corresponding four weeks of 1907.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

| Locality. | Fortnight ended. | Receipts for the fortnight. £ | £* | No. of wks. | Total to date. £ | £* | Route miles open. | Inc. |
|---|---|---|---|---|---|---|---|---|
| Aberdeen | Mar. 18 | 2,284 | + 28 | 42 | 57,333 | — 1,240 | 14·4 | .. |
| Ayr | ,, 21 | 363 | + 10 | 45 | 12,899 | + 20 | 8 | .. |
| Bath | ,, 21 | 1,185 | — 65 | 11 | 6,210 | — 483 | 13 | .. |
| Belfast | ,, 20 | 7,070 | + 166 | 51 | 184,969 | +11,838 | 36 | .. |
| Birkenhead | ,, 22 | 1,945 | — 15 | 50 | 53,414 | + 502 | 13·52 | .. |
| Birmingham Corp. | ,, 14 | 12,582 | +1,828 | 11 | 66,021 | + 9,658 | 56·46 | .. |
| Blackburn | ,, 18 | 1,928 | + 113 | 51½ | 55,509 | + 3,783 | 14·13 | .. |
| Blackpool Corp. | ,, 19 | 771 | — 16 | .. | 51,745 | — 1,156 | 11·87 | .. |
| ,, — Fleetw'd. | ,, 21 | 437 | + 31 | 11 | 2,355 | + 62 | 8·25 | .. |
| Bolton | ,, 22 | 4,171 | + 33 | 51 | 114,186 | + 6,624 | 26 | .. |
| Bournemouth | ,, 18 | 2,817 | + 197 | 50½ | .. | .. | 21·5 | .. |
| Bradford | ,, 14 | 8,338 | + 227 | 50 | 227,723 | + 5,559 | 54·9 | 1 |
| Brighton | ,, 22 | 1,344 | — 122 | 51 | 44,372 | — 3,345 | 9·5 | .. |
| Bristol | ,, 20 | 8,902 | — 264 | .. | .. | .. | 12·21 | .. |
| Brit. Elec. Trac. Co. | | | | | | | | |
| Airdrie | ,, 13 | 436 | + 12 | 10 | 2,284 | + 98 | 3·65 | .. |
| Barnsley | ,, 13 | 327 | + 5 | ,, | 1,659 | + 100 | .. | .. |
| Barrow | ,, 13 | 426 | — 1 | ,, | 2,184 | + 75 | 5·37 | .. |
| Cavehill | ,, 13 | 110 | + 1 | ,, | 579 | + 69 | .. | .. |
| Devonport | ,, 13 | 800 | + 21 | ,, | 4,269 | — 1 | 3·85 | .. |
| Gateshead | ,, 13 | 1,905 | — 1 | ,, | 10,075 | + 385 | 11·25 | .. |
| Gravesend | ,, 13 | 362 | — 63 | ,, | 1,895 | + 162 | 6·5 | .. |
| Greenock | ,, 13 | 931 | — 262 | ,, | 4,734 | — 1,086 | 7·25 | .. |
| Hartlepool | ,, 13 | 396 | — 77 | ,, | 2,246 | — 166 | 6·72 | .. |
| Kidderminster | ,, 13 | 170 | — 6 | ,, | 854 | — 15 | .. | .. |
| Leamington | ,, 13 | 266 | + 5 | ,, | 1,325 | + 171 | 3 | .. |
| Merthyr | ,, 13 | 382 | — 2 | ,, | 1,962 | + 42 | 2·9 | .. |
| Metropolitan | ,, 13 | 9,472 | +1,946 | ,, | 47,892 | +10,548 | 22 | .. |
| Middleton | ,, 13 | 618 | + 34 | ,, | 3,051 | + 173 | 3·5 | .. |
| Mid. Joint Com'tee | ,, 13 | 11,022 | + 212 | ,, | 55,027 | + 1,345 | .. | .. |
| Oldham—Ashton | ,, 13 | 1,113 | + 8 | ,, | 5,676 | + 89 | 9·13 | .. |
| Peterborough | ,, 13 | 200 | + 5 | ,, | 1,044 | + 71 | 5·31 | .. |
| Potteries | ,, 13 | 3,615 | + 7 | ,, | 18,954 | + 714 | 20 | .. |
| Rothesay | ,, 13 | 92 | — 2 | ,, | 492 | — 45 | 2·75 | .. |
| Southport | ,, 13 | 426 | + 13 | ,, | 1,972 | — 80 | 3·17 | .. |
| S. Metropolitan | ,, 13 | 1,279 | — 28 | ,, | 6,559 | + 116 | .. | .. |
| Swansea | ,, 13 | 1,694 | + 179 | ,, | 8,440 | + 668 | 5·5 | .. |
| Tynemouth | ,, 13 | 256 | — 31 | ,, | 1,425 | — 28 | 3·75 | .. |
| Weston-s-Mare | ,, 11 | 43 | — 7 | ,, | 242 | — 2 | 3 | .. |
| ‡Worcester | ,, 13 | 460 | + 3 | ,, | 2,368 | + 75 | 5·75 | .. |
| Wrexham | ,, 13 | 180 | — 1 | ,, | 897 | .. | .. | .. |
| Yorks. Wool. Dist. | ,, 13 | 1,686 | — 200 | ,, | 8,678 | — 247 | 17 | .. |
| Miscellaneous | ,, 18 | 179 | — 7 | ,, | 1,851 | + 26 | .. | .. |
| Burnley | ,, 21 | 2,235 | + 27 | .. | .. | .. | 7·5 | .. |
| Burton-on-Trent | ,, 22 | 460 | — 55 | 51 | 14,104 | — 696 | 11 | 2 |
| †Bury | ,, 15 | 1,032 | + 114 | 50 | 54,878 | + 6,711 | 10·5 | .. |
| Carlisle | ,, 21 | 272 | — 22 | 12 | 1,744 | + 68 | .. | .. |
| Chatham and Dist. | ,, 19 | 1,187 | — 72 | 11 | 6,712 | — 249 | 12·21 | .. |
| Cork | ,, 19 | 785 | — 63 | 11 | 4,324 | — 270 | 9·89 | .. |
| Croydon | ,, 20 | 2,444 | — 81 | 51 | 70,160 | — 1,479 | 12 | ·75 |
| Darlington | ,, 21 | 866 | — 20 | 51 | 10,125 | + 29 | .. | .. |
| Darwen | ,, 20 | 445 | — 26 | 51 | 12,724 | — 83 | 4·36 | .. |
| Dover | ,, 14 | 298 | — 51 | 50 | 10,702 | — 1,334 | 4·75 | .. |
| Dublin | ,, 20 | 9,727 | + 185 | .. | 53,954 | + 2,080 | 54·25 | 5·5 |
| Dundee | ,, 18 | 2,117 | + 73 | 44 | 50,217 | + 2,254 | 14·5 | .. |
| East Ham | ,, 21 | 1,613 | — 85 | 51 | 45,418 | + 847 | 7·75 | .. |
| Glasgow | ,, 21 | 33,295 | — 217 | 41½ | 729,285 | +18,084 | 89·25 | 5·5 |
| Hastings | ,, 19 | 1,462 | — 114 | .. | .. | .. | .. | .. |
| Huddersfield | ,, 21 | 2,874 | — 39 | 51 | 79,591 | + 3,269 | .. | .. |
| Hull | ,, 21 | 4,757 | + 82 | 51 | 125,595 | + 6,847 | 13 | .. |
| Ilkeston | ,, 18 | 251 | + 8 | 51 | 7,088 | + 427 | 3·5 | .. |
| Ipswich | ,, 21 | 586 | — 36 | 51 | 19,586 | — 1,141 | 10·5 | .. |
| †Kilmarnock | ,, 14 | 138 | — 17 | 48 | 6,766 | — 173 | 4·25 | .. |
| Lan'kshire Trm.Co. | ,, 19 | 2,388 | + 322 | 11 | 13,804 | + 2,432 | 15·82 | 3·96 |
| Lancashire United | ,, 18 | 2,281 | + 100 | 11 | 12,568 | + 992 | 99 | 1 |
| Leeds | ,, 14 | 12,067 | + 82 | 50 | 322,537 | +12,959 | 96 | 6·5 |
| Leicester | ,, 21 | 4,068 | — 96 | .. | .. | .. | .. | .. |
| Leith | ,, 14 | 962 | + 21 | 43½ | 22,441 | + 209 | 6 | .. |
| Liverpool | ,, 14 | 20,855 | + 116 | 11 | 108,618 | + 667¼ | 104 | .. |
| ‡L.C.C. | ,, 7 | 60,149 | +5,032 | 49 | 1,520,207 | +237,89 | 116¾ | 1·5 |
| London United | ,, 21 | 10,674 | — 416 | .. | 59,445 | — 488 | .. | .. |
| Lowestoft | ,, 21 | 265 | + 9 | 24 | 3,910 | + 160 | 3·5 | .. |
| Manchester | ,, 21 | 27,652 | + 991 | 51 | 744,624 | +48,916 | 86 | 11 |
| Newcastle | ,, 21 | 7,218 | — 683 | 51 | 205,648 | — 22 | .. | .. |
| Newport | ,, 14 | 1,191 | .. | 50 | 33,193 | + 2,085 | 14·5 | .. |
| Northampton | ,, 20 | 740 | — 3 | 49½ | 21,502 | — 203 | 5·5 | .. |
| Oldham | ,, 22 | 3,589 | + 18 | 52 | 99,009 | + 6,266 | 23·75 | .. |
| Pontypridd | ,, 7 | 608 | + 289 | 49 | 13,585 | + 5,462 | 5 | 1·75 |
| Portsmouth | ,, 21 | 2,958 | — 75 | 51 | 95,743 | — 815 | 14·5 | .. |
| Preston | ,, 18 | 1,294 | — 62 | .. | .. | .. | .. | .. |
| Reading | ,, 19 | 1,056 | — 85 | 50½ | 30,818 | — 736 | 13·25 | .. |
| Rotherham | ,, 19 | 1,148 | + 47 | 50½ | 30,588 | + 4,595 | 10 | ·66 |
| Salford | ,, 16 | 8,448 | + 85 | 49 | 229,427 | + 6,859 | 38·9 | .. |
| Sheffield | ,, 22 | 10,484 | — 835 | 52 | 287,295 | +11,233 | 35·75 | .. |
| Southampton | ,, 18 | 1,793 | + 154 | 50½ | 51,030 | + 3,842 | .. | .. |
| Southend-on-Sea | ,, 18 | 634 | + 23 | 51 | 19 310 | + 327 | .. | .. |
| †Sunderland | ,, 15 | 1,054 | — 122 | 50 | 66,327 | — 2,864 | .. | .. |
| †Swindon | ,, 11 | 137 | — 2 | .. | .. | .. | 4·4 | .. |
| Tyneside | ,, 18 | 677 | — 122 | 12 | 3,296 | — 310 | 3·87 | .. |
| Wallasey | ,, 21 | 1,441 | — 104 | 50 | 41,729 | + 663 | 6·72 | ·22 |
| Walthamstow | ,, 21 | 198 | + 58 | 51 | 29,756 | + 1,996 | 9 | .. |
| West Ham | ,, 19 | 4,161 | — 95 | 50 | 113,673 | + 2,161 | 14·7 | .. |
| Wolverhampton | ,, 18 | 1,505 | — 40 | 50 | 46,359 | + 570 | 12·6 | .. |
| Baker St.-Waterloo | ,, 21 | 6,030 | +1,455 | 12 | 37,105 | + 8,774 | 4·26 | 1 |
| Cen. London Rly. | ,, 21 | 12,064 | — 441 | 12 | 73,497 | — 2,963 | 5·77 | .. |
| Char. +, Eus. Hamp. | ,, 21 | 6,295 | .. | 12 | 37,760 | .. | 7·75 | .. |
| City & S. Lon. Rly. | ,, 22 | 6,544 | — 854 | 12 | 40,685 | + 4,089 | 7·3 | 1·05 |
| Dublin-Lucan Rly. | ,, 20 | 209 | + 20 | 12 | 1,074 | + 85 | 7 | .. |
| G.N. and City Rly. | ,, 21 | 3,324 | — 317 | 12 | 21,771 | — 960 | 3·5 | .. |
| G.N., P'dy. & Brmp. | ,, 21 | 10.715 | +2,680 | 12 | 61,720 | +19,421 | 9·25 | ·25 |
| L'pool Overh'd Rly. | ,, 22 | 2,770 | — 6 | 12 | 16,520 | + 48 | 6·8 | 4·3 |
| Mersey Railway | ,, 21 | 3.828 | + 171 | 12 | 22,838 | + 1,038 | 4·5 | .. |
| Metropolitan Rly. | ,, 22 | 30 204 | + 918 | 12 | 182,356 | + 1,956 | 24·5 | .. |
| Met. District Rly. | ,, 21 | 17,781 | +1,492 | 12 | 107,279 | +10,957 | 24 | .. |
| Anglo-Argentine | ,, 18 | 37,666 | +3 211 | 11 | 201,259 | +27,201 | 48 | .. |
| §Auckland | Feb. 28 | 11,997 | +1,909 | 8½ | 25,898 | + 3,582 | 19·2 | ·56 |
| Bombay (B.E.T.) | ,, 20 | 4,615 | + 695 | 8 | 19,626 | + 9,193 | .. | .. |
| §Brisbane | Jan. 31 | 14.340 | +1,875 | .. | .. | .. | .. | .. |
| †Buenos A.& Belgr'o. | Mar. 11 | 3,858 | + 195 | 10 | 37,901 | + 632 | .. | .. |
| Calcutta | ,, 21 | 6 240 | + 215 | .. | .. | .. | .. | .. |
| §CapeElectricT.Ld. | Jan. | 15,474 | .. | .. | .. | .. | .. | .. |
| §Geneva | Feb. | 6,940 | + 709 | .. | .. | .. | .. | .. |
| §Kalgoorlie, W.A. | ,, | 3,417 | .. | 8 | 7,055 | .. | 20·5 | .. |
| Madras | Mar. 15 | 1,410 | + 288 | 10½ | 6,461 | + 931 | 12·75 | .. |
| Perth (W.A.) | ,, 20 | 2 974 | — 58 | 12 | 16,989 | — 712 | 25·6 | 25·6 |

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

## STOCKS AND SHARES.

Tuesday Evening.

For one reason or another, the reduction in the Bank Rate to 3 per cent. has done the Stock Exchange little good. In general business there is virtually no increase. New issues receive support of the most capricious kind. This one goes well; the next, not dissimilar in character, is left almost entirely in the hands of the underwriters. Singular times, these are, and the Stock Exchange will be thankful to see *autres temps*, in the hope that they may possibly bring *autres mœurs* in the matter of investment.

Three hundred mortgage Debentures of £100 each, bearing interest at the rate of 5 per cent. have been offered by the North Metropolitan Electric Power Supply Company, Ltd. So small an amount would hardly seem to have been worth while advertising for its own sake alone.

Newcastle-on-Tyne Electric new Preference are in demand at ⅛ premium, although the Ordinary have been somewhat neglected. The former changed hands as high as 5s. premium in small lots.

Another new issue in which electric work may be concerned is the two million pounds Preference stock now offered by the London and North-Western Railway at 107. Whether any of this will be applied to the construction of the contemplated electric line from Euston to Watford is, however, not stated in the prospectus.

Central Londons are improving at last, and a sharp rise in Metropolitan Consolidated shows that speculative investment is alive to the possibilities of good traffics which are offered by the forthcoming exhibition at Shepherd's Bush this summer. Districts are dull, and City and South London remains without appreciable change.

City and South London 4 per cent. Debenture stock—to the cheapness of which attention was directed last week—has advanced to 103½. Great Northern, Piccadilly and Brompton 4 per cent. Debenture rose to 88½, and Bakerloo Debenture to 90½. Charing Cross and Euston Debenture is 81—84.

The Charing Cross and Strand Electric new issue of Debenture stock was taken as well as its supporters anticipated. That some of the holders of shares realised in order to apply for the new Debenture seems somewhat likely, because Ordinary and Preference are both a little lower. Electric lighting securities need to be made very attractive nowadays if they are to catch a popular success, because the experiences of the electric market during the last half decade have not been such as to inspire the investor with surplus confidence.

Westminster Electrics are flat, having fallen 15s. Other London shares remain fairly steady. Oxfords recovered the half-crown deducted ten days ago on account of the dividend distribution.

Movements in the Telegraph list are less exciting than, say, Peckham politics. Anglo-Americans are rather easier; West India and Panama Ordinary eased off 7½d. In the Eastern group there is no change at all. Investors may be reminded that on Eastern Telegraph Ordinary and on Eastern Extension shares the yield to a buyer at to-day's prices is 5¼ per cent. Both companies have fine reserve funds.

Marconi shares slid back to 10s. Oriental Telephones are easier, and the National Telephone Preferred and Deferred are both a little lower.

Matters in the London United Tramways Company march steadily from bad to worse. The report, out this week, shows that the Ordinary shares will receive no more dividend for 1907 than the 1 per cent. declared as an interim distribution six months ago. We have so long and so repeatedly criticised the company's financial methods, that to dwell upon them now is more than usually distasteful, because the concern caters, and caters well, for a great public necessity. But its system of finance—the over-capitalising, the neglect of adequate reserve and depreciation, the extravagant policy pursued in extending lines before they were necessary—these are still matters of the utmost gravity to the welfare of the undertaking. It is not surprising to find the Preference shares offered at 7½, the Ordinary at 5, and not a buyer of either in the London market. The Debenture stock lost a point at 83, but whether a few thousands of stock could be sold at 82, or 81, we are extremely doubtful.

The matter of reserve fund has been somewhat scantily treated by the Anglo-Argentine Tramways Company, whose report came out at the end of last week. Some people go so far as to question the wisdom of paying any dividend at all on the Ordinary shares, declaring that this money should rather be put into some reserve fund. The quoted issues remain without movement, and the figures of the report are not at all unsatisfactory in themselves.

Remarkable to relate, there is no decline this week in British Electric Tractions. Potteries Preference shed a small fraction; there are a few hundreds on offer at about 13s. Metropolitan Electric Tramways Preference are a trifle easier. Brush Preference have been marked down.

Manufacturing shares are quiet. British Aluminium 7 per cent. Preference fell ⅛, despite the big return offered by the shares at the present price. One or two Debenture stocks hardened, noticeably those of British Thomson-Houston and Dick, Kerr & Co.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. * | Dividends for the last four years. 1904. | 1905. | 1906. | 1907. | Closing Quotations Mar. 17th. | Closing Quotations Mar. 24th. | Business done week ended Mar. 24th, 1908. Highest | Lowest. | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | Nil | Nil | Nil | .. | 2 — 3 | 2 — 3 | .. | .. | .. | Nil |
| 143,300 | Do. do. 5 % Debs., Nos. 1 to 1,250 Red. | 100 | Nil | 5 % | 5 % | .. | 84 — 87 | 84 — 87 | .. | .. | .. | 5 14 11 |
| $131,551,400 | American Telephone & Telegraph, Cap. Stock | $100 | 7½% | 7½% | 8 % | .. | 110 —114 | 110 —114 | .. | .. | .. | 7 0 4 |
| 53,000,000 | Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000 | $1000 | 4 % | 4 % | 4 % | .. | 85 — 87 | 85 — 87 | .. | .. | .. | 4 12 0 |
| 622,600 | Anglo-American Telegraph .. .. .. .. | Stock | 2⅜% | 3½% | 3⅞% | 3½% | 54 — 57 | 54 — 57 | .. | .. | .. | 6 2 10 |
| 3,188,700 | Do. do. do. 6 % Pref. .. .. | Stock | 5½% | 6 % | 6 % | 6 % | 98 —100 | 97 — 99 | 99 | 97½ | —1 | 6 3 9 |
| 3,188,700 | Do. do. do. Deferred .. .. | Stock | Nil | ⅛% | 1⅜% | 1 % | 12½ — 14 | 13⅜ — 13⅞ | 13 1/16 | 13½ | — ⅛ | 7 6 10 |
| 50,000 | Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red. | 100 | .. | 5 % | 5 % | 5 % | 98½ —101½ | 98½ —101½ | .. | .. | .. | 4 18 6 |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 .. .. | 5 | 8 % | 8 % | 8 % | .. | 7 — 7½ | 7 — 7½ | .. | .. | .. | 5 6 8 |
| 2,300,459 | Commercial Cable Stng. 500 year 4 % Deb. Sk. Red. | Stock | 4 % | 4 % | 4 % | .. | 87 — 90 | 87 — 90 | 88½ | 86 | .. | 4 8 11 |
| 16,000 | Cuba Telegraph .. .. .. .. .. | 10 | 5 % | 5 % | 5 % | .. | 7 — 8 | 7 — 8 | 7⅞ | .. | .. | 6 5 0 |
| 6,000 | Do. 10 % Pref. .. .. .. .. | 10 | 10 % | 10 % | 10 % | .. | 16 — 17 | 16 — 17 | 16⅛ | .. | .. | 5 17 8 |
| 12,931 | Direct Spanish Telegraph, Ord. .. .. | 5 | 4 % | 4 % | 4 % | .. | 3½ — 3¾ | 3¼ — 3½ | .. | .. | .. | 5 14 3 |
| 6,000 | Do. do. 10 % Cum. Pref. .. | 5 | 10 % | 10 % | 10 % | .. | 8½ — 9¼ | 8¼ — 9⅛ | .. | .. | .. | 5 5 3 |
| 80,000 | Do. do. 4½ % Debs. .. .. | 50 | 4½% | 4½% | 4½% | .. | 99½ —102½ | 99½ —102½ | .. | .. | .. | 8 15 8 |
| 60,710£ | Direct United States Cable .. .. .. | 20 | 3½% | 4½% | 4⅝% | .. | 13⅜ — 14⅜ | 13⅜ — 14⅜ | 13⅞ | 13 1/16 | .. | 6 11 0 |
| 53,700£ | Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R. | 100 | 4½% | 4½% | 4½% | .. | 99 —101 | 99 —101 | .. | .. | .. | 4 9 1 |
| 4,000,000 | Eastern Telegraph, Ord. Stock .. .. .. | Stock | 7 % | 7 % | 7 % | .. | 130 —135 | 130 —135 | 132⅜ | 131 | .. | 5 3 8 |
| 2,000,000 | Do. 3½ % Pref. Stock .. .. .. | 100 | 3½% | 3½% | 3½% | .. | 83 — 86 | 83 — 86 | 84 | .. | .. | 4 1 5 |
| 1,896,706 | Do. 4 % Mort. Deb. Stock. Red. .. | Stock | 4 % | 4 % | 4 % | .. | 100 —103 | 100 —103 | 102⅝ | 101½ | .. | 3 17 8 |
| 300,000 | Eastern Extension, Australasia, and China Tele. | 10 | 7 % | 7 % | 7 % | .. | 12⅝ — 13½ | 12⅝ — 13½ | 13 | 12⅝ | .. | 5 5 8 |
| 752,400 | Do. 4 % Deb. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 99 —102 | 99 —102 | 100⅜ | 100½ | .. | 3 18 5 |
| 286,800 | East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 98 —101 | 98 —101 | .. | .. | .. | 3 19 3 |
| 200,000£ | Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 3,000 | 25 | 4 % | 4 % | 4 % | .. | 99 —101 | 99 —101 | .. | .. | .. | 15 17 0 |
| 181,127 | Globe Telegraph and Trust .. .. .. | 10 | 5⅜% | 5½% | 5½% | .. | 9½ — 10½ | 9½ — 10½ | 10¼ | 9¼ | .. | 5 7 4 |
| 181,127 | Do. do. 6 % Pref. .. .. .. | 10 | 6 % | 6 % | 6 % | .. | 13⅜ — 14⅜ | 13⅜ — 14⅜ | 13⅝ | 13¼ | .. | 4 4 11 |
| 150,000 | Great Northern Telegraph, of Copenhagen .. .. | 10 | 24 % | 24 % | 20 % | .. | 31 — 33 | 31 — 33 | 32½ | .. | .. | 6 1 3 |
| 24,300£ | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. | 100 | 4½% | 4½% | 4⅜% | .. | 99 —101 | 99 —101 | .. | .. | .. | 4 9 1 |
| 17,000 | Indo-European Telegraph .. .. .. .. | 25 | 13 % | 13 % | 13 % | .. | 54 — 57 | 54 — 57 | 56 | .. | .. | 6 11 7 |
| $41,380,400 | Mackay Companies Common .. .. .. .. | $100 | 1 % | 2 % | 3½% | .. | 58 — 63 | 58 — 63 xd | .. | .. | .. | 5 11 1 |
| $50,000,000 | Do. 4% Cum. Pref. .. .. .. | $100 | 4 % | 4 % | 4 % | .. | 61 — 67 | 62 — 65 xd | .. | .. | .. | 6 3 1 |
| 384,190 | Marconi's Wireless Telegraph .. .. .. | 1 | Nil | Nil | Nil | .. | ⅞ — 1 | ⅞ — 1 | 10/- | .. | — 7/16 | Nil |
| 72,680 | Monte Video Telephone Co., Ltd. Ord. .. | 1 | 4 % | 5 % | 6 % | .. | 1 1/16 — 1 1/16 | 1 1/16 — 1 1/16 | 20/- | 19/9 | .. | 4 14 1 |
| 86,492 | Do. do. do. 5 % Pref. .. | 1 | 5 % | 5 % | 5 % | .. | 1 — 1 | 1 — 1 | .. | .. | .. | 5 0 0 |
| 2,225,000 | National Telephone, Pref. Stock .. .. .. | 100 | 6 % | 6 % | 6 % | 6 % | 106½—108½ | 106 —108 | 107½ | 106 | — ½ | 5 11 1 |
| 3,341,425 | Do. do. Def. Stock .. .. .. | 100 | 5 % | 5 % | 5 % | 6 % | 108 —110 | 107½—109½ | 109 | 108 | — ½ | 5 9 7 |
| 15,000 | Do. do. 6 % Cum. 1st. Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 10 — 12 | 10 — 12 | .. | .. | .. | 5 0 0 |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | 6 % | 6 % | 5 % | 5 % | 10 — 12 | 10 — 12 | 10½ | 10⅜ | .. | 4 3 4 |
| 250,000 | Do. do. 5 % Non-cum. 3rd P., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5⅜ — 5⅝ | 5⅜ — 5⅝ | 5 1/16 | 5 1/16 | .. | 4 8 11 |
| 2,000,000 | Do. do. 3½ % Deb. Stock Red. .. | Stock | 3½% | 3½% | 3½% | 3½% | 97 — 99 | 97 — 99 | 98¼ | .. | .. | 3 11 1 |
| 1,710,093 | Do. do. 4 % Deb. Stock Red. .. .. | 100 | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | 102 | 101½ | .. | 3 17 8 |
| 179,313 | Oriental Telep. and Elec. 1 to 171,504, fully paid .. | 1 | 6¾% | 7 % | 7 % | .. | 1⅛ — 1⅛ | 1 3/16 — 1 5/16 | 25/3 | 25/- | + 1/16 | 5 6 8 |
| 50,000 | Do. do. 6 % Cum. Pref. .. .. | 1 | 6 % | 6 % | 6 % | .. | 1 3/32 — 1 3/32 | 1 3/32 — 1 3/32 | .. | .. | .. | 4 18 0 |
| 99,100 | Do. do. do. 4 % Red. Deb. Stock .. | 100 | .. | 4 % | 4 % | .. | 90 — 93 | 90 — 93 | 90 | .. | .. | 4 6 0 |
| 99,400 | Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000 | 10 | 4 % | 4 % | 4 % | .. | 98 —101 | 98 —101 | .. | .. | .. | 3 19 3 |
| 11,889† | Reuter's .. .. .. .. .. .. .. | 8 | 5 % | 5 % | 5 % | .. | 7¼ — 8¼ | 7¼ — 8¼ | 7⅞ | .. | .. | 4 19 3 |
| 99,100 | Telephone Co. of Egypt, 4½ % Deb. Red. .. .. | 100 | .. | 4½% | 4½% | .. | 99 —102 | 99 —102 | .. | .. | .. | 4 8 3 |
| 3,167 | Submarine Cables Trust .. .. .. .. | Cert. | 6 % | 6 % | 6 % | .. | 127 —130 | 127 —130 | .. | .. | .. | 4 12 4 |
| 100,000 | United River Plate Telephone .. .. .. .. | 5 | 8 % | 8 % | 8 % | .. | 6 — 6½ | 6 — 6½ | 6⅝ | 6 | .. | 6 3 1 |
| 40,000 | Do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | 5 % | 5 % | 5 % | .. | 4¾ — 5¼ | 4¾ — 5¼ | .. | .. | .. | 4 15 3 |
| 15,609£ | West African Telegraph, Shares .. .. .. | 10 | 4½% | 4 % | 4 % | .. | 10 — 10½ | 10 — 10½ | .. | .. | .. | 3 16 2 |
| 30,008 | W. Coast of America, 1 to 30,000 & 53,001 to 53,008 | 2 | Nil | Nil | 2½% | .. | 98 —101 | 98 — 101 | 98½ | .. | .. | 3 19 3 |
| 150,000 | Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 % | 4 % | 4 % | .. | 13½ — 13⅝ | 13⅛ — 13⅜ | 13½ | 13 1/16 | .. | 5 1 10 |
| 207,930 | Western Telegraph, Ltd., Nos. 1 to 207,930 .. .. | 10 | 7 % | 7 % | 7 % | .. | 98½—101½ | 98½—101½ | .. | .. | .. | 3 19 3 |
| 800,000 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | .. | ⅝ — ¾ | ½ — ⅝ | 11/- | 10/- | — 1/16 | Nil |
| 88,321 | West India and Panama Telegraph .. .. | 10 | Nil | Nil | Nil | .. | 8 — 8½ | 8 — 8½ | 8 1/16 | .. | .. | 9 8 2 |
| 34,563 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 6 % | 5 % | 8 % | .. | 8 — 8½ | 8 — 8½ | .. | .. | .. | Nil |
| 4,669 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | Nil | Nil | Nil | .. | 8 — 8½ | 8 — 8½ | .. | .. | .. | 4 17 1 |
| 80,000£ | Do. do. 5 % Debs., Nos. 1 to 1,800 .. | 100 | 5 % | 5 % | 5 % | 5 % | 100 —103 | 100 —103 | .. | .. | .. | |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 320,000 | Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097 | 5 | 8 % | 8 % | 8 % | .. | 8 — 8½ | 8 — 8½ | 8¼ | 8 1/16 | .. | 4 15 6 |
| 260,007 | Do. 6 % Cum. Prefs., 1 to 260,007 .. | 5 | 5⅜% | 5⅜% | 5⅜% | .. | 6 — 6½ | 6 — 6½ | 6 1/16 | 6 1/16 | .. | 4 8 0 |
| 266,600 | Do. Permanent, 6 % Deb. Stock, 1888 | 100 | 6 % | 6 % | 6 % | .. | 129 —132 | 129 —134 | .. | .. | .. | 4 10 11 |
| 285,100 | Auckland E. Trams, 5 % 1st Mort. Deb. Stock .. | 100 | 5 % | 5 % | 5 % | .. | 104 —107 | 104 —107 | 104 | .. | .. | 4 13 6 |
| 530,000 | Babcock & Wilcox, 1 to 530,000 .. .. .. | 1 | 20 % | 20 % | 20 % | .. | 3½ — 3⅝ | 3⅝ — 3¾ | 75/- | 73/9 | + 1/8 | 5 0 8 |
| 100,000 | Do. do. 6 % Cum. Pref., 1 to 100,000 .. | 1 | 6 % | 6 % | 6 % | .. | 1 1/16 — 1 1/16 | 1 1/16 — 1 1/16 | .. | .. | .. | 3 16 10 |
| 40,000 | British Aluminium, Ord., 1 to 40,000 .. .. | 5 | 7 % | 7 % | 7 % | .. | 3⅞ — 4¼ | 3⅞ — 4¼ | 75/- | .. | — 1/8 | 8 9 8 |
| 40,000 | Do. do. 7 % Cum. Pref. .. .. | 5 | 7 % | 7 % | 7 % | .. | 4⅛ — 4⅜ | 4⅛ — 4¼ | .. | .. | .. | 7 3 7 |
| 20,000 | Do. do. "A" 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | .. | 4⅛ — 5⅛ | 4⅛ — 5⅛ | .. | .. | .. | 5 11 1 |
| 20,000 | Do. do. 4 % Funding Certs. .. .. | 5 | 4 % | 4 % | 4 % | .. | 3¾ — 4¼ | 3¾ — 4¼ | .. | .. | .. | 4 14 1 |
| 238,200 | Do. do. 5 % 1st Mort. Deb. Stock Red. | Stock | 5 % | 5 % | 5 % | .. | 100 —103 | 100 —103 | .. | .. | .. | 5 13 5 |
| 800,000 | Do. do. 5½ % Loch Leven Debs. .. | 100 | .. | .. | 5½% | 5½% | 97 —100 | 97 —100 | .. | .. | .. | 5 10 0 |
| 400,000 | British Columbia E. Rail Def. Ord. Stock .. | 100 | 6 % | 6 % | 6 % | .. | 127 —130 | 127 —130 | .. | .. | .. | 4 12 4 |
| 800,000 | Do. 5 % Pref. Ord. Stock .. .. | 100 | 5 % | 5 % | 5 % | .. | 107 —111 | 108 —112 | 110 | 106½ | +1 | 4 9 8 |
| 800,000 | Do. 5 % Cum. Perp. Pref. Stock .. .. | 100 | 5 % | 5 % | 5 % | .. | 105 —109 | 105 —109 | 108 | .. | .. | 4 11 9 |
| 235,000 | Do. 4½ % 1st Mort. Debs., 1 to 6,250 .. .. | 40 | 4½% | 4½% | 4½% | .. | 101 —104 | 101 —104 | .. | .. | .. | 4 6 7 |
| 220,000 | Do. 4½ % Vancouver Power Debs., 1 to 2,200 | 100 | 4½% | 4½% | 4½% | .. | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 133,301 | British Electric Traction .. .. .. .. | 10 | 6 % | 8 % | Nil | .. | 1¼ — 1⅜ | 1¼ — 1⅜ | .. | .. | .. | Nil |
| 161,437 | Do. do. 6 % Cum. Pref. .. .. | 10 | 6 % | 6 % | 6 % | .. | 4⅛ — 4⅜ | 4 — 4⅛ | 85/- | 82/6 | — 1/8 | 13 6 8 |
| 1,448,653 | Do. do. 5 % Perp. Deb. Stock .. | Stock | 5 % | 5 % | 5 % | .. | 97 —100 | 97 —100 | 98¼ | 97½ | .. | 5 0 0 |
| 410,178 | Do. do. 4½ % 2nd Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | .. | 72 — 76 | 72 — 76 | .. | .. | .. | 5 18 5 |
| 100,000 | British Insulated and Helsby Cables .. .. | 5 | 8 % | 8 % | 10 % | .. | 6⅞ — 7⅛ | 6⅞ — 7⅛ | .. | .. | .. | 7 0 4 |
| 100,000 | Do. do. 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 5⅝ — 6⅛ | 5⅝ — 6⅛ | 5⅞ | .. | .. | 4 18 0 |
| 500,000 | Do. do. 4½ % 1st Mort. Deb. Red. .. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —104 | 102 —105 | .. | .. | +1 | 4 5 9 |
| 212,080 | British Thomson-Houston 4½ % 1st Mort. Debs. .. | 100 | 4½% | 4½% | 4½% | .. | 86 — 89 | 86 — 91 | .. | .. | +1½ | 4 15 9 |
| 400,000 | British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 | 5 | Nil | Nil | Nil | .. | ⅜ — ⅞ | ⅜ — ⅞ | 12/6 | 10/3 | .. | Nil |
| 1,016,353 | Do. do. 4 % Mort. Deb. Stock .. | 100 | 4 % | 4 % | 4 % | .. | 45 — 50 | 45 — 50 | .. | .. | .. | 8 0 0 |
| 50,000 | Browett, Lindley & Co., Ord. .. .. .. | 1 | Nil | Nil | Nil | .. | 9/16 — 11/16 | 9/16 — 11/16 | .. | .. | .. | Nil |
| 50,000 | Do. do. 6 % Cum. Pref. .. .. | 1 | Nil | Nil | Nil | .. | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. | .. | Nil |
| 105,731 | Brush Electrical Engineering, Ord., 1 to 105,731 .. | 2 | Nil | 2½% | Nil | .. | 0 — ½ | 0 — ½ | .. | .. | .. | Nil |
| 150,000 | Do. do. Non-cum. 6 % Pref. .. .. | 2 | 6 % | 6 % | Nil | .. | 3/16 — 1/4 | 3/16 — 1/4 | .. | .. | — 1/16 | Nil |
| 125,000£ | Do. do. 4½ % Perp. Deb. Stock .. | Stock | 4½% | 4½% | 4½% | .. | 77 — 80 | 77 — 80 | .. | .. | .. | 5 12 6 |
| 125,000£ | Do. do. 4½ % Perp. 2nd Deb. Stock .. | Stock | 4½% | 4½% | 4½% | .. | 63 — 66 | 63 — 66 | .. | .. | .. | 6 16 4 |
| 100,000 | Buenos Ayres & Belgrano, 1 to 100,000 .. .. | 5 | 4 % | 3 % | 3 % | .. | 4⅜ — 4⅝ | 4⅜ — 4⅝ | .. | .. | .. | 3 1 6 |
| 40,000 | Do. do. "A" 6 % Cum. Pref., 1 to 40,000 | 5 | 6 % | 6 % | 6 % | 6 % | 4⅜ — 5⅛ | 4⅜ — 5⅛ | .. | .. | .. | 5 17 1 |
| 27,500 | Do. do. "B" do., 1 to 27,500 .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 4⅜ — 5⅛ | 4⅜ — 5⅛ | .. | .. | .. | 5 17 1 |
| 310,000 | Do. do. 5 % Deb. Stock .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 110 —116 | 110 —116 | 113 | .. | .. | 4 6 3 |
| 190,000 | Do. do. 5 % 2nd Deb. Stock .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —105 | 102 —105 | .. | .. | .. | 4 15 3 |
| 137,610 | Calcutta Trams, 1 to 137,610 .. .. .. | 5 | 8 % | 8 % | 8 % | .. | 6⅞ — 7⅛ | 6⅞ — 7⅛ | 6⅞ | 6⅝ | .. | 5 8 6 |
| 80,000 | Do. 5 % Cum. Pref., Nos. 1 to 29,330 .. | 5 | .. | .. | 5 % | 5 % | 5 — 5⅛ | 5 — 5⅛ | .. | .. | .. | 4 13 0 |
| 350,000 | Do. 4½ % 1st Deb. Stock .. .. | 100 | 4½% | 4½% | 4½% | .. | 101 —105 | 101 —105 | .. | .. | .. | 4 5 9 |
| 85,000 | Callender's Cable Construction shares .. .. | 5 | 12½% | 15 % | 15 % | .. | 10⅞ — 11⅞ | 10⅞ — 11⅞ | .. | .. | .. | 5 7 8 |
| 40,000 | Do. do. 5 % Cum. Pref. .. .. .. | 5 | 5 % | 5 % | 5 % | .. | 5⅛ — 5⅜ | 5⅛ — 5⅜ | .. | .. | .. | 4 5 11 |
| 300,000 | Do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | .. | 106 —108 | 106 —108 | 106⅛ | .. | .. | 4 4 1 |
| 491,222 | Cape E Trams., 1 to 491,222 .. .. .. | 1 | 5 % | Nil | Nil | .. | ⅞ — 1 | ⅞ — 1 | .. | .. | .. | Nil |
| 450,000 | Castner-Kellner Alkali, 1 to 450,000 .. .. | 1 | 4 % | 6 % | 8 % | .. | 1⅛ — 1⅜ | 1⅛ — 1⅜ | 26/9 | .. | .. | 5 16 4 |
| 215,045 | Do. do. 4½ % 1st Mort. Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 1,893,610 | Central London Railway, Ord. Stock .. .. | Stock | 4 % | 4 % | 4 % | 3 % | 63 — 66 | 65 — 68 | 68 | 65¾ | +2 | 4 8 3 |
| 553,195 | Do. do. 4 % Pref. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 82 — 84 | 82 — 84 | 83¾ | 82¾ | .. | 4 15 3 |
| 553,195 | Do. do. Def. do. .. .. | Stock | 4 % | 4 % | 4 % | 2 % | 42 — 45 | 42 — 45 | .. | .. | .. | 4 8 11 |
| 1,480,000 | City and South London Railway .. .. .. | Stock | 2½% | 1⅞% | 2½% | 2½% | 37 — 39 | 37 — 39 | 38 | 37½ | .. | 5 9 0 |

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. | | | | Closing Quotations Mar. 17th. | Closing Quotations Mar. 24th. | Business done week ended Mar. 24th, 1908. | | Rise + or Fall — | Present Yield per cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | * | 1904. | 1905. | 1906. | 1907. | | | Highest. | Lowest. | | £ s. d. |
| 85,000 | Crompton & Co., Nos. 1 to 85,000 | £ | 2½% | 2½% | 5 % | .. | 1½ — 2 | 1½ — 2⅛ | .. | .. | .. | 7 10 11 |
| 100,000£ | Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red. | .. | 5 % | 5 % | 5 % | .. | 92 — 95 | 92 — 95 | .. | .. | .. | 5 5 8 |
| 260,000 | Dick, Kerr & Co., 1 to 260,000 | 1 | 10 % | 10 % | 10 % | .. | 1⅛ — 1⅜ | 1⅛ — 1⅜ | .. | .. | .. | 7 5 5 |
| 305,000 | Do. do. 6 % Cum. Pref., 1 to 305,000 | 1 | 6 % | 6 % | 6 % | .. | 1⅛ — 1⅛ | 1⅛ — 1⅛ | 21/3 | .. | .. | 5 8 3 |
| 282,580 | Do. do. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | .. | 99 —102 | 100 —103 | .. | .. | + 1 | 4 7 5 |
| 60,000 | Dublin United Trams. (1896), 1 to 60,000 | 10 | 6 % | 6% | 6 % | 6¾% | 12½ — 13½ | 12½ — 13½ | .. | .. | .. | 4 18 2 |
| 59,987 | Do. 6 % Pref. between 1 and 60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 12⅝ — 13⅝ | 12⅝ — 13⅝ | 12⅛ | .. | .. | 4 7 3 |
| 99,261 | Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261 | 5 | 2½% | 4½% | 4½% | .. | ¾ — 1 | ¾ — 1 | .. | .. | .. | 12 10 0 |
| 17,139 | Do. "A" shares, 01—017,139 | 5 | 2½% | 4½% | 4½% | .. | 1⅞ — 2⅛ | 1⅞ — 2⅛ | .. | .. | .. | 8 6 9 |
| 319,475 | Do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | .. | 78 — 81 | 78 — 81 | 79½ | 79 | .. | 4 18 9 |
| 72,220 | Do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | 5 % | 5 % | 5 % | .. | 87 — 90 | 87 — 90 | .. | .. | .. | 5 11 1 |
| 112,100 | Electric Contraction, 1 to 112,100 | 2 | Nil | Nil | Nil | .. | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. | .. | Nil |
| 31,390 | Do. do. 7 % Cum. Pref., 1 to 31,390 | 2 | 7 % | 7 % | Nil | .. | 1⅛ — 1½ | 1⅛ — 1½ | .. | .. | .. | Nil |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | .. | 7⅞ — 8⅛ | 7⅞ — 8⅛ | 8 | 7⅞ | .. | 6 1 3 |
| 200,000 | Do. do 4 % Mort Deb. | Stock | 4 % | 4 % | 4 % | .. | 89 — 92 | 89 — 92 | .. | .. | .. | 4 19 11 |
| 78,000 | Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000 | 10 | 4 % | 4 % | 4 % | .. | 1 — 1⅛ | 1⅛ — 1⅜ | .. | .. | .. | 20 0 0 |
| 96,000 | Greenwood & Batley, 7 % Cum. Pref. | 10 | 7 % | 7 % | 7 % | .. | 10¼ — 10¾ | 10⅝ — 10¾ | .. | .. | .. | 6 10 8 |
| 80,000 | Do. do. 5 % Mort. Debs. | 100 | 5 % | 5 % | 5 % | .. | 102 —103 | 102 —103 | .. | .. | .. | 4 17 1 |
| 40,000 | Henley's (W. T.), Telegraph Works, Ord. | 5 | 15 % | 15% | 15 % | 15% | 10¼ — 11⅛ | 11⅜ — 12⅜ | 11 | 10½ | .. | 7 8 1 |
| 40,000 | Do. do. 4½ % Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4⅜ — 5¼ | 4⅜ — 5¼ | 5⅜ | .. | .. | 8 17 3 |
| 150,000 | Do. do. 4½ % Mort. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 106 —108 | 106 —108 | .. | .. | .. | 4 3 4 |
| 50,000 | India-Rubber, Gutta-percha & Telegraph Works | 10 | 5 % | 10% | 10 % | .. | 15⅜ — 16½ | 15⅜ — 16½ | 16¼ | 15⅞ | .. | 6 1 3 |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | 1½% | Nil | Nil | ¾% | 1⅜ — 1½ | 1⅜ — 1⅝ | .. | .. | .. | Nil |
| 10,000 | † Do. do. Pref., fully paid | 10 | 5 % | 5 % | 5 % | 5 % | 5 — 5½ | 5⅛ 6 | .. | .. | — ⅛ | 8 6 8 |
| 600,070 | London United Trams. (1901), 1 to 50,007 | 10 | 6 % | 8 % | 8 % | .. | 6¼ — 6⅝ | 6⅜ — 6⅝ | .. | .. | .. | 4 8 11 |
| 399,930 | Do. do. 50,008 to 100,000 | 10 | 6 % | 8 % | 8 % | .. | 6¼ — 6⅝ | 6⅜ — 6⅝ | .. | .. | .. | 4 8 11 |
| 125,000 | Do. do. 5 % Cum. Pref., 1 to 125,000 | 10 | 5 % | 5 % | 5 % | .. | 7 — 8 | 7 — 8 | .. | .. | .. | 5 17 8 |
| 1,931,000 | Do. do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | 4 % | .. | 82 — 86 | 81 — 85 | 82⅝ | 82 | —1 | 4 14 2 |
| 5,732,062 | Metropolitan Consolidated | 100 | 3 % | 2⅝% | 1 % | ¾% | 35 — 36 | 38 — 39 | 38⅝ | 35½ | +2½ | 1 5 8 |
| 2,640,914 | Do. Surplus Lands | 100 | 2⅜% | 2⅜% | 2⅜% | 2⅜% | 66 — 68 | 66 — 68 | 67½ | 66⅜ | .. | 4 0 11 |
| 3,235,000 | Do. District | 100 | Nil | Nil | Nil | Nil | 9½ — 10½ | 9½ — 10½ | 10⅛ | 10 | .. | Nil |
| 314,016 | Metropolitan Electric Trams., Defd. | 1 | Nil | Nil | Nil | .. | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | Nil |
| 600,000 | Do. do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | 15/32 — 17/32 | 1/2 — 17/32 | 15/9 | .. | — 1/32 | 5 14 3 |
| 350,000 | Do. do. 4½ % Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 97 — 99 | 96 — 99 | .. | .. | — ¼ | 4 10 11 |
| 245,500 | Potteries E. Trc. | 1 | 5 % | 4 % | 4 % | .. | ¼ — ⅜ | ¼ — ⅜ | .. | .. | .. | 8 0 0 |
| 245,500 | Do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ⅛ — ⅛ | ⅛ — ⅛ | .. | .. | .. | 7 5 5 |
| 245,000 | Do. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 98 — 96 | 98 — 96 | .. | .. | .. | 4 18 9 |
| 37,350 | Telegraph Construction and Maintenance | 12 | 15 % | 15 % | 15 % | 17½% | 31 — 33 | 32½ — 34½ | 32⅜ | 31 | — 1/16 | 7 15 7 |
| 150,000£ | Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 100 —103 | 100 —103 | .. | .. | .. | 3 17 8 |
| 3,599,200 | Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. | .. | 5 % | 5 % | 5 % | .. | 40 — 44 | 40 — 44 | 42 | .. | .. | 11 7 4 |
| 66,666 | Willans & Robinson, 1 to 30,000 & 80,001 to 116,666 | 1 | Nil | Nil | Nil | 5 %§ | 1 — 1⅛ | 1 — 1⅛ | .. | .. | .. | 6 13 4 |
| 66,666 | Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666 | 5 | Nil | Nil | .. | 6 % | 3¼ — 3½ | 3¼ — 3½ | .. | .. | .. | 0 3 |
| 46,404 | Do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 72 — 77 | 72 — 77 | .. | .. | .. | 5 1 0 |

### ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15,000 | Bromley (Kent) E.L. & P,. 1 to 15,000 | 5 | 5⅛% | 5⅛% | 5⅛% | .. | 4⅝ — 5⅛ | 4⅝ — 5⅛ | .. | .. | .. | 5 7 4 |
| 70,000 | Do. do. 4½ % 1st. deb. stock | 100 | 4½% | 4½% | 4½% | 4½% | 96 — 99 | 96 — 99 | .. | .. | .. | 4 10 11 |
| 30,131 | Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000 | 5 | 10 % | 10 % | 10% | 10 % | 7⅞ — 8½ xd | 7⅞ — 8½ | 7⅜ | .. | .. | 5 17 8 |
| 9,869 | Do. do. 7 % Cum. Pref. | 5 | 7 % | 7 % | 7 % | 7 % | 6½ — 7⅝ xd | 6⅝ — 7⅝ | 7⅛ | 7⅛ | .. | 4 10 4 |
| 336,876 | Central Electric Supply 4 % Guar. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 98 — 101 | 98 —101 | .. | .. | .. | 3 19 3 |
| 80,000 | Charing Cross and Strand Electricity Supply | 5 | 8 % | 5 % | 5 % | 5 % | 4⅜ — 4⅝ xd | 4 — 4⅛ | .. | .. | — ⅛ | 5 11 1 |
| 80,000 | Do. do. do. 4½ % Cum. Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4¼ — 4⅝ | 4⅛ — 4⅝ | .. | .. | .. | 4 14 9 |
| 80,000 | Do. "City Undertaking" 4½ % Cum. Prf. | 5 | 4½% | 4½% | 4½% | 4½% | 4¼ — 4⅝ | 4⅛ — 4⅝ | 82/6 | .. | — ⅛ | 4 17 4 |
| 445,736 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 96 — 99 | 96 — 99 | .. | .. | .. | 4 0 10 |
| 49,436 | Chelsea Electricity Supply, Ord. | 5 | 6 % | 6 % | 4½% | .. | 3⅜ — 3⅝ | 3⅜ — 3⅝ | 72/6 | .. | .. | 6 4 2 |
| 175,000£ | Do. do. 4½ % Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | .. | 101 —104 | 101 —104 | .. | .. | .. | 4 6 7 |
| 70,595 | City of London Elec. Lighting, Ord. 40,001—110,595 | 10 | 6 % | 6 % | 6 % | 6 % | 10 — 11 | 10 — 11 | 10½ | 10⅛ | .. | 5 9 1 |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 | 10 | 6 % | 6 % | 6 % | 6 % | 11½ — 12½ | 11½ — 12½ | .. | .. | .. | 4 16 0 |
| 400,000£ | Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd. | .. | 5 % | 5 % | 5 % | 5 % | 122 —125 | 122 —125 | 124 | .. | .. | 4 0 0 |
| 800,000 | Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | 101½ | .. | .. | 4 6 7 |
| 40,000 | County of Durham Electrical Power, Ord. | 5 | £3 7 0 | 4 % | 4 % | .. | 3 — 3⅜ xd | 3 — 3⅜ | .. | .. | .. | 5 6 8 |
| 50,000 | Do. do. do. 5 % Pref. | 5 | 5 % | 5 % | 5 % | .. | 4½ — 4⅝ xd | 4½ — 4⅝ | .. | .. | .. | 5 5 3 |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 | 10 | 4½% | 5 % | 5 % | 5 % | 7⅝ — 8⅛ | 7⅝ — 8⅛ | 8 | 7⅞ | .. | 6 3 1 |
| 40,000 | Do. do. 6 % Pref., 40,001—60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 11 — 11½ | 11 — 11½ | 11⅝ | 11½ | .. | 5 4 4 |
| 400,000£ | Do. do. 4½ % Deb. Stock | .. | 4½% | 4½% | 4½% | 4½% | 105 —108 | 105 —108 | 107½ | .. | .. | 5 7 10 |
| 400,000 | Do. do. 4½ % 2nd. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 97 — 100 | 97 —100 | .. | .. | .. | 4 10 0 |
| 80,000 | Edmundson's Electric Corporation, Ord. Shares | 5 | 7 % | 4 % | Nil | .. | ⅛ — ⅜ | ⅛ — ⅜ | 5/- | .. | .. | 11 0 0 |
| 80,000 | Do. do. 6 % Cum. Pref. | 5 | 6 % | 6 % | 3 % | .. | ¼ — 1½ | ¼ — 1½ | 15/- | .. | .. | 12 0 1 |
| 433,000 | Do. do. 4½ % 1st Mort. Deb. Stk. | 100 | 4½% | 4½% | 4½% | .. | 60 — 70 | 60 — 70 | .. | .. | .. | 6 8 7 |
| 10,000 | Folkestone, 1 to 10,000 | 5 | 5½% | 5½% | 5½% | .. | 4⅝ — 5½ | 4⅝ — 5½ | .. | .. | .. | 5 7 4 |
| 10,000 | Do. 5 % Cum. Pref., 1 to 10,000 | 5 | .. | 5 % | 5 % | .. | 5 — 5½ | 5 — 5½ | .. | .. | .. | 4 10 11 |
| 90,000 | Do. 4½ % 1st Deb. Stock | 100 | 4½% | 4½% | 4½% | .. | 94 — 97 | 94 — 97 | .. | .. | .. | 4 12 9 |
| 15,000 | Hove, 1 to 13,000 | 5 | 8½% | 9 % | 9 % | .. | 6¼ — 6⅝ | 6¼ — 6⅝ | 6⅞ | .. | .. | 6 18 4 |
| 21,000 | Kensington and Knightsbridge Electric Ord. | 5 | 12 % | 10 % | 10 % | .. | 7⅞ — 8⅛ xd | 7⅞ — 8⅛ | .. | .. | .. | 5 14 3 |
| 90,000 | Do. do. do. 4 % Deben. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 96 — 99 | 96 — 99 | 97½ | .. | .. | 4 0 10 |
| 10,000 | London Electric Supply Corporation, Limited, Ord. | 3 | 3 % | 4 % | 4 % | 2½% | 1⅛ — 1⅜ xd | 1⅛ — 1⅜ | .. | .. | .. | 4 13 0 |
| 70,000 | Do. do. do. 6 % Pref. | 5 | 6 % | 6 % | 6 % | 6 % | 4⅜ — 5 | 4⅜ — 5 | .. | .. | .. | 6 0 0 |
| 374,395 | Do. do. 4 % 1st Mort. Deb. Stk. Red. | Stock | 4 % | 4 % | 4½% | 4½% | 90 — 93 | 90 — 93 | .. | .. | .. | 4 16 9 |
| 200,000 | Metropolitan Electric Supply, 1 to 100,000 | 5 | 10 % | 10 % | 8 % | 6½% | 5 — 5⅛ xd | 5 — 5⅛ | 5⅛ | 5⅛ | .. | 6 8 9 |
| 76,121 | Do. 4½ % Cum. Pref. 1—71,106 | 5 | 4½% | 4½% | 4½% | 4½% | 4⅜ — 5¼ | 4⅜ — 5¼ | .. | .. | .. | 3 18 3 |
| 220,000£ | Do. 4½ % 1st Mort. Deben. Stock | .. | 4½% | 4½% | 4½% | 4½% | 107 —111 | 107 —111 | 109½ | .. | .. | 4 1 1 |
| 250,000£ | Do. 3½ % Mort. Deben. Stock Redem. | Stock | 3½% | 3½% | 3½% | 3½% | 85 — 90 | 85 — 90 | .. | .. | .. | 3 17 9 |
| 250,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. | 100 | 4½% | 4½% | 4½% | .. | 97 —100 | 97 —100 | .. | .. | .. | 4 10 0 |
| 87,500 | Newcastle-on-Tyne, 1 to 87,500 | 5 | 8 % | 8 % | 8 % | .. | 6⅛ — 6⅜ xd | 5⅞ — 6⅛ | .. | .. | — ⅛ | 6 10 7 |
| 87,500 | Do. 5 % Pref., 1 to 87,500 | 5 | 5 % | 5 % | 5 % | .. | 5⅛ — 5⅜ | 5⅛ — 5⅜ | .. | .. | .. | 4 10 11 |
| 10,852 | Notting Hill Electric Lighting | 10 | 7 % | 7½% | 7½% | 7½% | 11½ — 12½ xd | 11½ — 12½ | .. | .. | .. | 6 5 0 |
| 20,000 | Oxford, 1 to 96 and 407 to 20,310 | 5 | 7 % | 7 % | 7 % | 7 % | 5½ — 6 xd | 5⅝ — 6⅛ | 5⅛ | 5⅛ | .. | 5 12 0 |
| 50,000 | Do. 4 % Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 93 — 95 | 93 — 95 | .. | .. | .. | 5 17 8 |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. | 5 | 14½% | 12½% | 10 % | 10 % | 7⅞ — 8⅛ | 7⅞ — 8⅛ | .. | .. | .. | 5 14 3 |
| 20,000 | Do. do. 7 % Pref. 20,081 to 40,080 | 5 | 7 % | 7 % | 7 % | 7 % | 6¾ — 7 | 6¾ — 7 | .. | .. | .. | 5 0 0 |
| 150,000£ | Do. do. 3½ % Deb. Stock Red. | 100 | 3½% | 3 % | 3½% | 3½% | 85 — 90 | 85 — 90 | .. | .. | .. | 3 17 9 |
| 12,000 | Smithfield Markets Electric Supply, Ord. | 5 | 4 % | 4 % | Nil | Nil | ⅛ — 1⅛ | ⅛ — 1⅛ | .. | .. | .. | Nil |
| 50,000 | Do. do. do. 4 % Deb. Stock | Stock | 4 % | 4 % | 4 % | 4 % | 70 — 74 | 70 — 74 | .. | .. | .. | 5 8 1 |
| 65,000 | South London Electricity Supply, Ord. | 5 | 4 % | 4 % | 3 % | .. | 2⅜ — 3⅛ | 2⅜ — 3⅛ | .. | .. | .. | 4 16 0 |
| 120,000 | South Met. Elec. Lt. & Power, Ord. | 1 | Nil | 2½% | 2½% | 2½% | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. | .. | 3 6 8 |
| 117,968 | Do. do. 7 % Pref. | 1 | 7 % | 7 % | 7 % | 7 % | 1⅛ — 1⅜ | 1⅛ — 1⅜ | .. | .. | .. | 5 1 10 |
| 200,000 | Do. do. 4½ % 1st Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | .. | .. | .. | 4 6 7 |
| 80,000 | Urban Electric Supply, Ord. | 5 | 5 % | 5 % | 5 % | .. | 1½ — 2½ | 1½ — 2½ | .. | .. | .. | 12 10 0 |
| 50,000 | Do. do. 5 % Cum. Pref. | 5 | 5 % | 5 % | 5 % | .. | 2 — 2½ | 2 — 2½ | 40/- | .. | .. | 10 0 0 |
| 200,000 | Do. do. 4½ % 1st Mort. Db. Stk. Red. | 100 | 4½% | 4½% | 4½% | .. | 89 — 93 | 89 — 92 | .. | .. | — ½ | 4 17 10 |
| 110,000 | Westminster Electric Supply, Ord. | 5 | 14 % | 13 % | 12 % | 10 % | 7⅞ — 8⅛ | 7⅞ — 8 | 7⅞ | 7⅞ | — ⅛ | 6 5 0 |
| 81,279 | Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905) | 5 | 5 % | 5 % | 4½% | 4½% | 5 — 5⅛ | 5 — 5⅛ | 5⅛ | 5 | .. | 4 1 10 |

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 3 per cent., March 19th, 1908.

## PUBLICITY FOR SMALL UNDERTAKINGS.

By B. N.

(*Continued from page* 506.)

### Tariff (*continued*).

It may be of interest to consider in detail the system of special contracts, as it is not very largely used, though it appears to be a very useful and safe method of charging.

It has frequently been suggested that a price per kilowatt should be fixed, and the consumer allowed to make what use he liked of his kilowatt, and for as many hours per day as he required, a cut-out being provided to prevent him taking more than his agreed demand. This is quite a good arrangement, but, unfortunately, it makes the price of electricity prohibitive to all except the very few people who can take a supply for 20 or more hours per day.

It is, however, possible to charge a fixed price per kilowatt, plus a small price per unit, and to put in a cut-out for the purpose of preventing more than a certain current being taken. It is our old friend, the demand indicator, or more correctly, the Hopkinson system again, but it can be explained rather more easily and is not so terrifying to the consumer, and it has the advantage from the supply point of view that, no matter how many or how few units are used, the supply undertaking is certain to receive the interest on capital and standing charges. In fact, it cannot lose money on this system, whereas, on the demand-indicator system, if the consumer uses very few units, it can lose money.

This system can be further extended by arranging a contract for, say, five years, and adding to the annual charge per kilowatt a sum representing the hire-purchase instalments for wiring the premises, and, further, adding to the price per unit a sum to cover the cost of lamp renewals. The system can be still further extended by estimating the probable number of units required and adding all the items together to make one lump sum.

The manager can now go to the prospective consumer with a proposition somewhat as follows :—"You require 200 lamps to light your premises, but you will not require more than 150 on at once. Give me a contract for five years, and I will put in all the wiring free of cost to you. I think you will want 3,000 units a year, and I will provide these units. I will also give you all the lamps you require during the contract—all for a fixed sum per annum, say £100. I make only two stipulations : First, that you do not put on more than 150 lamps at once ; and, to keep us right on this point, I will put in a cut-out to prevent you from doing so. Second, that if you use more units than my estimate, you pay for any extra at the nominal price of, say, 1d. per unit."

The manager can point out that, if he uses double the estimated units, he only adds a small fraction to his total bill, owing to the low price at which the extra units are charged. A contract on these lines will often bring on a good consumer who would not think of accepting the ordinary rates. Many people will cheerfully pay a large account for lighting when they know beforehand almost exactly what the account will amount to. It is hardly necessary to point out that this system is very good for the supply authorities. They obtain a good consumer, they have him settled for a number of years and the terms are so arranged that they cannot lose by the transaction.

It is possible to extend the system even further than the case given above. Suppose there are some places where practically every lamp is alight during certain definitely fixed hours. This happens in a number of factories, for instance, and also in certain other businesses. Then, in these cases, the units to be used can be calculated with considerable accuracy ; and if a margin of 25 per cent. extra is allowed for carelessness in switching off, very little risk is run of the units being excessive. The manager can now make an offer as follows :—

"If you will give me a five years' contract, I will fit up so many lights on your premises, free of cost, supply you with all the current you require for these lights, and give you as many new lamps as you require—all for a fixed sum per annum."

This is a very attractive tariff, and has been used in at least one town, apparently with success.

Many managers may be afraid of these people leaving lights on all day, but it is usual to arrange in the agreement for the supply authority to have access to the premises to check waste ; and, in a small town, where there will not be more than, say, 20 such consumers, it is not difficult to keep a check on what is happening. In any case, if lights are left on, it only costs the central station a small sum for a little extra coal. It is not recommended that this system should be used indiscriminately, and it is, perhaps, wise to restrict it to people paying £50 per annum or more for lighting.

The details of any scheme of this nature require careful consideration, but nothing has been said on this subject, because a scheme that will suit one town will not suit another. Of course, every manager would prefer to get business on a simple tariff, and those who can do so are advised to leave these alternatives alone ; but in cases where business is difficult to get, the manager must adapt himself and his tariffs to the needs of the people, and keep on working out alternatives until he hits on something which appeals to the particular class of consumer he is anxious to connect up.

### Publicity Schemes.

The manager of the supply undertaking having arranged his tariff and decided on his policy in the matter of free wiring, hire, hire-purchase, &c., is now confronted by the difficulty of bringing these matters strongly before the people he wants to reach.

There is no difficulty in carrying out a publicity campaign if there is no limit to the money that may be spent, but it is a very difficult business to plan a system which shall pay for itself by the results achieved. It is by no means an easy matter to determine whether the publicity campaign is paying, partly because it is not easy to calculate in £ s. d. how much the undertaking has benefited by the scheme, and partly because the effect of a publicity scheme is cumulative—that is, the result for the first few months may be very disappointing, but yet, by steadily working up all the possible consumers and by keeping on bringing to their notice different facts and arguments, the ultimate result may be very satisfactory.

No publicity scheme should be condemned because it has not brought in much new business during its first year, but, on the other hand, the very fact that it is so long before the results can be ascertained should make all managers exceedingly careful in the choice of the scheme they adopt, because, if the scheme is a failure, they will have spent a lot of money before the result is known, all of which may be dead loss. For this and other reasons it is generally best to begin work on a comparatively small scale, and gradually to add new items to the scheme as time goes on, and some sort of idea can be obtained of the way the different ideas are received by the public.

The first point to be decided is the amount that may be profitably spent on publicity. This amount depends almost entirely on the financial position of the undertaking.

If the station has been running for only a short time, the plant and mains will probably be lightly loaded and the revenue will be so small that, after paying working expenses, there will be nothing left for interest charges and depreciation. Under these conditions of working, any increase in business is exceedingly valuable, because, until the load grows sufficiently to necessitate extensions, the interest charges, &c., will remain constant and, in the majority of cases, the working expenses will increase by only a very small sum ; therefore, every additional consumer brings in a large profit to the undertaking, and a comparatively high price can be profitably paid to secure new business.

It should, however, be remembered that when an undertaking is new, business ought not to be very difficult to obtain, for there are always a certain number of people who will use electricity under almost any circumstances, and it takes very little work to secure this class ; for this reason the manager should carefully consider his own town before spending a large sum on publicity merely because he badly wants new business. He may find that a considerable amount of new business can be obtained at a very low cost.

The case of an undertaking that has been running for some time is rather different, because it may be assumed that the easily obtained consumers are all connected up; but yet the station may not be doing sufficient business to make it pay. If, under these circumstances, the plant is not fully loaded, it is obvious that anything which will bring new consumers or increase the consumption of old consumers is of great value, and a considerable sum may be spent on publicity.

If the station is not paying, and yet the plant is fully loaded, it will be necessary for the management to consider the effect of putting down more plant. This is a matter of general management, and falls outside the scope of this article, but, assuming that it is decided to extend, then, again, new business is very desirable; but, since the station, though loaded up, was not paying before the extension, any publicity scheme should aim at securing the most profitable class of consumer.

The above cases are, to a certain extent, special, and by far the most usual condition of affairs is a supply that has been in existence some time, and is just hovering between a profit and a loss. How much can this station afford to spend on publicity?

It all depends on the price per unit that can be obtained, or, rather, it depends on the margin of profit on each unit. If the profit is high, a large sum may be economically spent on securing new business; but if the profit is small, the business is not so well worth having, and less can be paid to obtain it. In passing, it may be remarked that the Americans appear to work on a higher margin of profit than we do in this country, and this appears to be one of the principal reasons why publicity is more used there than here.

A consideration of the above points will show how greatly the profitable outlay on publicity will vary in different towns, and not only that, but it will vary at different times in the same town. Of course, it will not be possible to vary the amount that may be spent on publicity year by year to make it tally with the theoretical amount that may be spent, but it does seem both possible and advisable to adopt a fixed minimum scheme, and allocate extra sums for special efforts when these become urgent owing to any of the above causes.

It is not very difficult to say that there is a theoretical amount that may be spent, but it is quite another matter to determine what that amount is for any town. There are practically no published data to go upon, and the following suggestion is put forward more with the hope that it may call attention to the matter than with the belief that it is a solution of the difficulty.

The problem may be stated as follows:—In a small town of 30,000 inhabitants, it may be possible by publicity methods to increase the revenue by £400 per annum above the present rate of increase. How much may profitably be spent on publicity to achieve this result? In attempting to arrive at an answer, it must be remembered that a consumer secured is usually secured for a number of years, and the value of his continued business must be credited to the publicity scheme. Suppose, therefore, we allocate a percentage of his yearly account for a number of years to this purpose, the question now arises, for how many years is this allocation to continue? It is suggested that five years would be a fair figure, mainly because it is not safe to look further ahead than five years: a conservative manager might be inclined to allow a shorter period.

The next point is, "What percentage should be allowed?" and this must be determined by a consideration of the position of the undertaking as outlined above, and the percentage allowed must be largely a matter of individual opinion. But, in the average town, working at the small margin of profit that it is possible to obtain at the present date, it does not seem likely that more than 5 per cent. on the yearly value of the business obtained can be allocated to publicity. Taking this 5 per cent. for five years, we get the figure of 25 per cent. of the annual increase due to publicity which may be allocated for the expenses of working it.

Applying this to the above case, it seems that if, by an expenditure of £100 per annum, additional business worth £400 per annum may be obtained, the publicity scheme may be said to pay. It must be remembered that this £400 is not the total yearly increase in the revenue, but is the extra increase that would not have been obtained but for the publicity scheme. It must always remain therefore to a certain extent an estimated figure, because it is impossible to say exactly what business is due to natural increase, and what to special advertising.

The whole business of systematic advertising of electricity supply is so new in this country that there is nothing by which to check this result, and it must remain at present little more than a guess; but, if other managers would express their opinion, it might be possible to arrive at a more accurate estimate.

It does not seem likely that the manager of a small undertaking will have very much money to spend on publicity, and it is therefore all the more necessary that he should see that every penny of it is usefully spent. The way in which it may most usefully be spent will vary in different towns, but it seems possible to lay down a few general rules with some degree of safety.

Perhaps the first thing the manager should decide is which class of business he is most anxious to obtain. In most cases he will want all the business he can get, but, in the case of a nearly fully loaded station, where extensions are held up for any reason, the manager will naturally want as much day load as possible: on the other hand, if he has a large day load, it may pay him better to get lighting business.

He may want all-night business to make his night shift pay (a very difficult matter in a small town), but he will be lucky if he can find it, apart from street lighting. In some cases he may not want all-night business, because, at present, he can run his night shift off the battery; but with a little more load he would have to go to the expense of running engines and boilers, when probably there is not sufficient all-night business in the town to make a night shift pay under these conditions. A consideration of these points will show that it must sometimes pay to push one line of business more than another.

If he decides that he is anxious to obtain a day load, then most attention must be given to power users; if a lighting load, then he must lay himself out to push lighting. He will soon find that the procedure must be radically different in the two cases.

Considering, first of all, the lighting business, it must at once be decided on what lines the showroom is to be run.

(*To be continued.*)

## THE MILWAUKEE NORTHERN RAILWAY.*

The Milwaukee Northern Railway, extending from Milwaukee, Wis., to Cedarburg and Port Washington, commenced operations on October 28th, 1907. This is the first division, 30 miles in length, of a system which is to extend as far as Sheboygan, and which is expected to be completed to that city by April 1st of this year; the line will then comprise a total length of 112 miles.

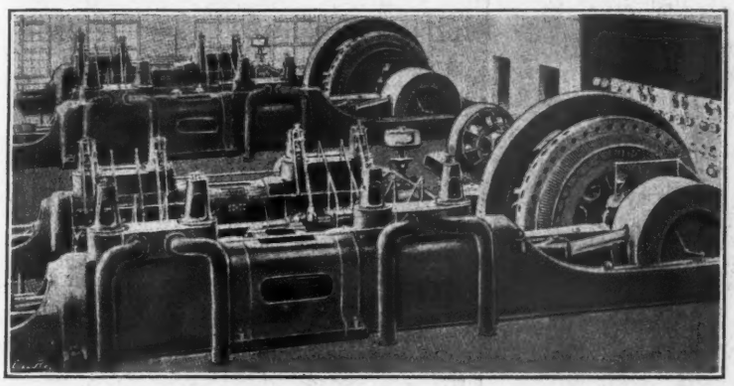
For the overhead equipment, cedar poles, with side-arm construction, are used on the private right of way; and wrought-iron posts, with span construction, are used in the cities. Spans are 105 ft. long on straight line. Telephone wires are also strung along the right of way, and communication with stations can be opened directly from any car by means of a pole and hook connection.

The feature of the equipment of the Milwaukee Northern Railway which has attracted special attention is the fact that the motive power of the road is furnished by gas-engine-driven electric generating units, of a size hitherto unknown to railway use in America. The main power plant is at Port Washington, on the harbour front, where the handling of coal, unloaded directly from lake steamers at the company's docks, is very economical and convenient. Two buildings accommodate the power plant proper, one for the gas producers and one for the engines, generators, switchboards and protective apparatus. The structures are approximately 50 ft. apart, and are of concrete, steel, and brick con-

* *The Railway and Engineering Review.* (Abstract.)

struction. The gas supply main is run outside and along the entire length of the power house from the producer plant.

The generating units are three in number, each of 1,000 KW. capacity. Two are now installed ; the third will be set up shortly. Each unit consists of a twin tandem, horizontal, double-acting gas engine direct connected to a 405-volt 25-cycle alternator. Although the rating of each unit is given as 1,000 KW., both engine and generator were designed with large over-load capacities, the engine being capable of developing upwards of 2,000 H.P., and the generator having a corresponding capacity. Each engine has four cylinders, 32 in. in diameter by 42 in. stroke, and operates at 107 R.P.M.



Gas-Driven Alternators.

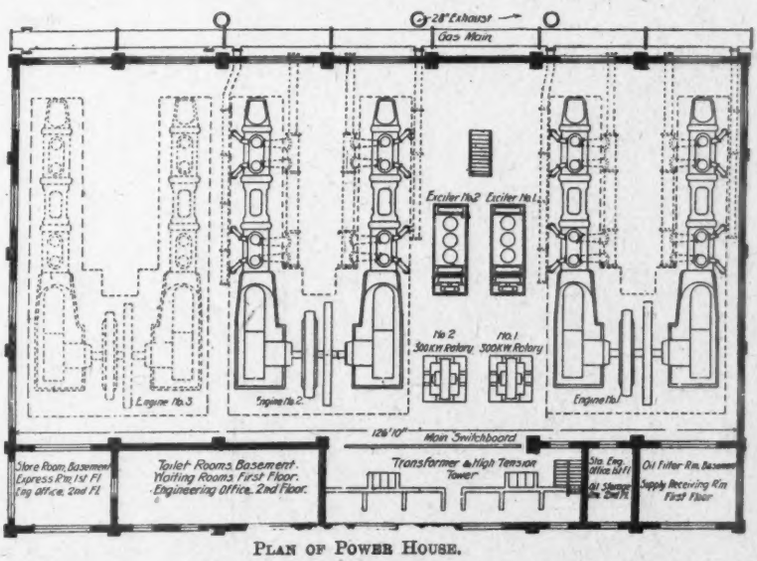
The valve gear is of the standard Allis-Chalmers cut-off type, and the engine operates with constant compression, thus tending to ensure smooth running under the highly variable loads to which it is subjected. The inlet gear is extremely simple, consisting of a main inlet valve of the single-beat poppet type, eccentric operated, thus ensuring long life and quiet running. The mixture of the air and gas is thoroughly effected before entering the cylinder by means of a patented annular mixing chamber under the main inlet bonnet. The design and operation of this device is such that, at the instant of the closing of the main inlet valve, there is practically no explosive mixture left outside the cylinder. The gas valve is of the double-beat poppet type controlled by a variable lift rolling lever operated by a single link connection to the main inlet gear, the lift of the valve, and consequently the amount of gas admitted and the time of admission being regulated by the governor. The exhaust gear is of the single-beat poppet valve type, eccentric operated, and is in this respect a duplicate of the main inlet gear. A distinctive feature of the Allis-Chalmers gas engine is the situation of this exhaust bonnet with its valve at the bottom of the cylinder, so that all the dirt is removed by the action of the exhaust gases, and the provision of a substantial jack to lower the entire exhaust mechanism out of place to allow of the inspection and re-grinding of the valve ; the jack also serves to swing the valve chamber, with the valve and its operating mechanism complete, out to one side where it can be reached by the crane hoist.

The igniters are electrically controlled and so arranged that the time of ignition may be regulated by a single hand-wheel. Direct current at 60 volts is used in the ignition system. Duplicate igniters are provided at each end of the cylinder to ensure the prompt firing of low heat value gases and also to avoid the danger of shut-down due to short circuit. The air starting device consists of a small poppet inlet air valve at each end of each cylinder, with a main distributing valve operated by the layshaft. Air is admitted to each cylinder in turn at what would be the explosion stroke. As the high compression carried prevents the engine from stopping on the dead centre, this arrangement ensures the prompt starting of even a tandem engine without the use of a barring gear. These Port Washington engines being twin tandem will, of course, start from any position.

The distinctive features of the engine are extreme simplicity of design, solidity of construction and quiet operation. The load at the present time is extremely variable, swinging from less than one half to 50 per cent. overload, with momentary peaks greatly in excess of this. It is said, however, that only by a study of the switchboard instruments is this apparent, for the engine handles the maximum overloads quite quietly, and with the same freedom from vibration as characterises its operation under normal conditions. The engine turns its centres as quietly as a slow-running Corliss engine, and is as indifferent to the rapid changes in load.

All wearing surfaces, including the main bearings, slides, crank and cross-head pins, are arranged for a continuous oiling system, and the cylinders are lubricated by carefully-timed admission of the cylinder oil, Richardson's sight-feed oil pumps being used. The water-cooling system includes ample provision for cooling the cylinder walls, cylinder heads, pistons, piston rods, exhaust valves, and exhaust bonnets. Water is circulated by means of two Morris and two Deming pumps, each driven by an Allis-Chalmers induction motor.

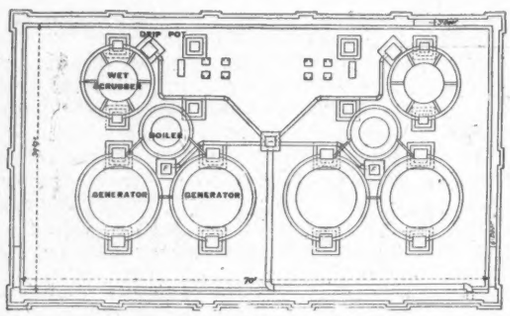
The gas for the engines is furnished by producers operating on the Loomis-Pettibone system. The present installation comprises two generating units, each consisting of a pair of gas producers connected to a common economiser, wet scrubber and exhaust. The gas is delivered into a holder of 30,000 cb. ft. capacity. The normal rating of the present plant is 4,000 H.P., and it has a capacity of 25 per cent. overload for five hours' duration. The brick building containing the apparatus is divided into a basement 19 ft. in depth and a single storey about 14 ft. in height to the eaves. The operating or charging floor is about 6 ft. above the level of the ground outside the building. A coal tank 50 ft. long is situated on the operating floor, with openings in front of the charging doors of the gas producers, thus bringing the fuel to points convenient to the man operating the gas plant. Hocking Valley bituminous slack coal, containing about 11,500 B.TH.U. per pound, is the fuel ordinarily


28" Exhaust
Gas Main
Exciter No.2
Exciter No.1
No. 2 300 K.W. Rotary
No. 1 300 K.W. Rotary
Engine No.3
Engine No.2
Engine No.1
126'10"
Main Switchboard
Store Room, Basement. Express Rm. 1st Fl. Eng. Office, 2nd Fl.
Toilet Rooms, Basement. Waiting Rooms, First Floor. Engineering Office, 2nd Floor.
Transformer & High Tension Tower
Sta. Eng. Office 2nd Fl.
Oil Filter Rm. Basement
Supply Receiving Rm. First Floor

Plan of Power House.

used. The plant is operated on the down-draft principle, the air being admitted through the charging door at the top of each producer, and the necessary suction being caused by an exhauster located beyond the wet scrubber. By this method the volatile matter and distillates are drawn through the deep bed of incandescent fuel and gasified, thus avoiding any tar-extracting machinery, and enabling the system to produce gas obtaining 80 per cent. of the heat units possessed by the fuel used. Reverse runs of steam, generated by the gas passing through the economiser or waste heat boiler, are occasionally made for the purpose of breaking up the fuel bed. The water gas made by this process mixes with the producer gas in the holder and slightly enriches it. The average calorific value of the gas as delivered from the holder is 125 B.TH.U. per cubic foot. The gas mains leading to the engines are equipped with Ludlow valves.

The electrical features of the power equipment may be briefly described as follows: Three-phase current is generated in the power house at 405 volts and 25 cycles by direct-coupled alternating-current generators, each of 1,000 KW. normal capacity. Current for excitation is




Plan of Gas-Producer House.

furnished by two 50-KW. 120-volt direct-current generators driven by vertical gas engines. The current from the main generators is delivered to a six-panel switchboard having three generator, one exciter and two transformer panels.

From the switchboard the current is carried to the step-up transformers and also to the rotary converter switchboard. There are seven step-up transformers of 500 KW. capacity each (one spare), which raise the voltage from 405 volts to a maximum of 22,000 volts, with intermediate taps to allow the voltage to be varied if desired. The current is carried from each bank of transformers to the high-tension 'bus through three oil switches of 40 amperes capacity each in each circuit, in addition to plug switches at each transformer, to allow of speedily cutting out any transformer in case of breakdown. From the high-tension 'bus three transmission lines are led away, each with automatic oil circuit-breakers of 40 amperes capacity in circuit.

For supplying near-by portions of the line, two 300-KW. rotary converters are provided in the main station.

There are eight sub-stations, two of which have each two 400-KW. 650-volt rotary converters and six 125-KW. 22,000-405-volt step-down oil-cooled transformers. The remaining six sub-stations have each two 300-KW. 650-volt rotary converters and six 100-KW. 22,000/405-volt step-down oil-cooled transformers.

The present rolling stock of the Milwaukee Northern includes eight heavy interurban cars of the type known as the semi-empire Pullman, built by the Niles Car Manufacturing Co., of Niles, Ohio. They are handsomely upholstered, commodious, and fitted with toilet room, electric heaters, &c. The seating accommodation provides for 52 passengers, and the cars are 50 ft. 4 in. in length, 8 ft. 10 in. in width over-all. The weight, including trucks and motors, is 70,000 lb., and there are two 75-H.P. motors on each truck.

The equipment is designed for a schedule speed of 25 M.P.H., with a possible maximum of 54 M.P.H.

The cars used in the local service within the city of Milwaukee are eight in number, 41 ft. long and 8 ft. 5 in. wide, and have rattan seats placed cross-wise. They are single-ended, with the motorman's vestibule entirely segregated from the platform. These cars are equipped with 40-H.P. motors. Schedule speed within the city of Milwaukee will be about 10 miles per hour. The operating schedule of the road gives hourly cars in each direction. The greater part of the road's equipment, including all of its power and electrical machinery, was built by Allis-Chalmers Co., Milwaukee.

## PROCEEDINGS OF INSTITUTIONS.

### Notes on Electric Lifts.

By H. D. Wilkinson, M.I.Mech.E., M.I.E.E.

(*Abstract of paper read before the* Association of Engineers-in-Charge *on March 11th*, 1908.)

The author called attention to the large increase in the demand for electric lifts, which had led to improvement in the details of construction, and had made electricity the most reliable form of power for this work. Although not a cheap machine, the electric lift is absolutely safe, and offers great advantages in control, simplicity and cheapnss of working.

The less economical, but simple, worm gearing was advocated in preference to the spur gearing which is used largely in America. This is quite in accordance with the best English practice, and the absolute reliance which the other method places on the brakes was considered to more than counterbalance the extra loss incurred in the worm gearing.

Several of the better known lifts were described, and details which had been variously adopted to surmount difficulties, as, for example, the Otis double worm to overcome trouble with end-thrust.

The following operations are considered essential to electric lifts:—

*First, for Starting the Lift—*

1. The motor armature connections to be made for the required direction of running.
2. The brake released and current applied to motor through starting resistance.
3. Starting resistance gradually cut out. (The motor then accelerates to normal speed.)
4. Accelerating winding, if any, cut out.
5. Field weakened for speeding above normal (if required).

*Second, for Stopping the Lift—*

1. Current cut off motor, and brake applied.
2. Starting resistance quickly put in.

With this operation the normal condition of the shunt field is restored and the acceleration coils (if any) are cut in again ready for a fresh start.

Preceding the first of these operations in stopping, a slowing-down device is introduced in some high-speed lifts before actual stopping takes place.

The gear has also to provide for the following contingencies:—

1. It must not be possible to put current on the motor armature till all the starting resistance is in. This condition must be maintained irrespective of how quickly the attendant puts over from "up" to "down" or "down" to "up."
2. It must not be possible through any cause for the brake to remain off, or the supply current to remain on the motor, when the attendant has put the starting handle over to the "off" or stopping position.
3. A mechanically operated device, worked either by drum motion or the cage, must be provided to perform automatically the attendant's duty in stopping the lift at the top and bottom floors should he fail to do so, or should some failure occur to the gear which he operates. This device to come into action when the cage has overrun the top or bottom floors by a few inches.
4. In passenger lifts or goods lifts in which an attendant may travel, there should be a further overwind prevention device as an ultimate limit.

This to be in the form of a knock-off switch cutting off the supply mains from the entire electric gear, and set to act when the cage has travelled a little beyond the previous limiting device, and at as great a distance as the clearance will allow before the balance weight or cage touches the bottom stops in the shaft.

These conditions were dealt with in detail, and the paper concluded with a tribute to the engineer in charge, who is responsible for keeping this class of plant in running order.

### Fuse Phenomena.

By Prof. Alfred Schwartz and W. H. N. James.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, March 3rd, and London, March 5th*, 1908.)

The authors point out the advantages of using a pure metal for fuse-wire and strip, preferably one of low melting point. Flame and molten metal may issue even from enclosed fuses, unless the ends are suitably guarded.

For the jackets of enclosed fuses, a combustible material, such as fibre, is inferior to porcelain, though it is cheaper and less liable to breakage.

The specific resistance and coefficient of increase in resistance with temperature for the various metals commonly employed as fuses are given in Table I, with other physical constants.

TABLE I.—Physical Constants for Metals Employed as Fuses.

| —— | Lead. | Copper. | Tin. | Zinc. | Cadmium. | Aluminium. |
|---|---|---|---|---|---|---|
| Density .. .. .. | 11·3 | 8·95 | 7·4 | 7·15 | 8·64 | 2·60 |
| Melting point, °C. .. | 327 | 1,054 | 230 | 412 | 321 | 657 |
| Boiling point, °C. .. | 1,173 | 2,100 | 1,450—1,600 | 930 | 782 | — |
| Specific resistance in legal microhms at 0° C. centimetre measure. | 19·4700 | 1·6200 | 13·1000 | 5·8000 | 10·0200 | 2·6600 |
| Temperature coefficient for resistance 0°-100° C. | 0·0041 | 0·0043 | 0·0044 | 0·0038 | 0·0042 | 0·0043 |
| Specific heat near melting point. | 0·0360 | 0·1180 | 0·0637 | 0·1040 | 0·0617 | 0·2077 |
| Relative mass of metal required for fuse of n.f.c. = 20 amperes, copper = 1. | — | 1·0000 | 2·9000 | 4·1000 | — | *0·8200 |

* In the case of aluminium a light spring attachment was used to break the circuit as soon as the wire melted.

Copper oxidises slowly at temperatures under red heat, and as, in open-type fuses, copper only becomes red hot when loaded to 75 per cent. of its fusing current, this metal is suited for circuits which will allow of an overload of the order of 75 per cent. or upwards.

Oxidisable metals, such as aluminium, zinc, cadmium, and tin, are capable of forming oxide sheaths strong enough to hold up the metal after fusion. This effect is particularly noticeable with small round wires.

In enclosed fuses silicious fiillings are capable of combining with the oxide sheath and of forming a containing tube around the arc. Such tubes at the high temperature at which they are formed would very probably conduct after the manner of Nernst filaments.

The boiling points of metals with low melting points, such as lead, tin, and zinc, are in the neighbourhood of 1,000° C., and it is certain that many of the globules of these metals, which are scattered on disruption, approximate to this temperature.

In general, the mass of metal in the fuse should be kept as small as possible for open-type fuses. In the screened shunted type of fuse it would seem possible to employ a metal with large mass and low melting point for the main fuse, as this will melt quite quietly, the break being made on the shunt, which is of high resistance, and is enclosed or protected. For fuses of large capacity this type is worthy of more attention than has hitherto been paid to it.

As the amount of current flowing on short-circuit largely affects the behaviour of the fuse on disruption, it becomes necessary to define it more strictly. This can be done by specifying the drop in volts in the leads with the normal fusing current of the fuse under test flowing; thus a 3 per cent. drop in volts would allow of a short-circuit current equal to 33 times the normal fusing current of the fuse under test, a 10 per cent. drop of ten times the normal fusing current, and so on.

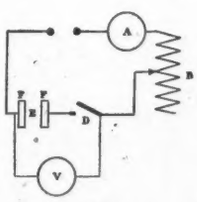



Fig. 1.

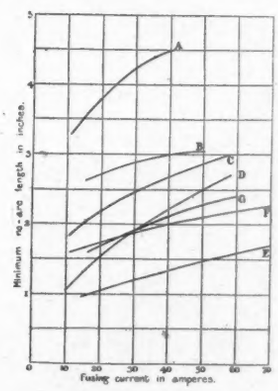



Fig. 2.

Fig. 1.—Diagram of Arrangements for Short-circuit Tests.

A, Ammeter to read normal fusing current; B, Adjustable low resistance; D, Main switch; F, Fuse terminals; V, Voltmeter for circuit voltage.

Fig. 2.

A, Copper wire free in air; B, Zinc strip free in air; C, Copper wire in tubular holder; D, Copper wire passing through asbestos partition at centre; E, Copper wire enclosed, with Calais sand filling; F, Copper wire enclosed on inductive circuit; G, Zinc strip enclosed on non-inductive circuit. All are on 220-volt circuit. A to E, Non-inductive; F, Inductive (0·023 henry).

A diagram of the testing arrangements employed by the authors is given in fig. 1. The method of working is as follows:—Across the terminals F in lieu of the fuse was placed an adjustable resistance E sufficient to carry the normal fusing current of the fuse under test.

The switch D was then closed and the resistance E adjusted, so that the ammeter A read the normal fusing current of the fuse under test.

The resistance B was adjusted so that the difference in readings on the voltmeter V with the switch D open and closed was the required drop. It is necessary that the resistance B should be small compared to the resistance E; an alteration in the value of B will alter the current read at A, and will necessitate a slight readjustment of E.

The resistance E was now removed and replaced by the fuse.

The 3 per cent. drop in pressure referred to has been found to be representative of the conditions likely to be met with in house services for main and distribution board fuses.

The minimum length of break was taken as the least length at which no damage was done to the terminals on short circuit, the resistance of the circuit being such as to give a 3 per cent. drop with the normal fusing current flowing. This length is referred to as the "minimum no-arc length."

There was a greater tendency for an arc to form across clean, freshly fused surfaces than across dirty surfaces, and therefore care was taken that for each new length of fuse experimented with, the surface was a clean one across which an arc had recently taken place.

For copper wires of 20 amperes N.F.C. and upwards on a 220-volt circuit the minimum no-arc length increases slightly as the drop in pressure in the circuit is reduced. With a 27-ampere (No. 25 S.W.G.) open-type copper fuse with large terminals (350 gm.), on a 220-volt circuit, the data are:—

| Short-circuit current in terms of the normal fusing current. | Minimum no-arc length in inches. |
|---|---|
| N.F.C. × 33 ... ... ... ... | 3·6 |
| N.F.C. × 10 ... ... ... ... | 2·9 |

With the same size of wire with small terminals:—

| | |
|---|---|
| N.F.C. × 33 ... ... ... ... | 4·20 |
| N.F.C. × 10 ... ... ... ... | 3·05 |

For smaller copper wires (Nos. 33 and 29 S.W.G.) in open-type cut-outs the minimum no-arc length seems to be larger with a short-circuit current of 10 times the normal fusing current than with a current 33 times the normal fusing current. The cooling effect of the terminals is concerned with the effect; a fuse blowing with a small overload melts first at the centre, where an arc is established which burns back towards the fuse terminals, whereas on short circuit the whole length of wire is disrupted practically simultaneously.

The wire becomes molten along its whole length, and under the influence of surface tension it segregates into a number of beads or globules, arcs forming between the beads where the cross-sectional area is reduced, the heat developed at these points being sufficient to vaporise the metal. Straight and curved white lines in photographs mark the paths of glowing globules of metal which have been ejected. With enclosed fuses the results of short circuits were much more severe with 33 × N.F.C. than with 10 × N.F.C.

The curve connecting the minimum no-arc length, and the normal fusing current for open-type copper fuses on a 220-volt non-inductive circuit (*i.e.*, with the inductance due to the generator and cables only) with short-circuit currents = 33 × N.F.C. is given in fig. 2, curve A.

With enclosed fuses the minimum no-arc length increases with the capacity of the fuse much in the same way as in the open type. The results for copper fuses up to 50 amperes on a 220-volt non-inductive circuit are shown graphically in fig. 2, curve E.

For open-type fuses the increase of the minimum no-arc length is at least in proportion to the increase in the circuit pressure.

Under the same conditions in open-type fuses the minimum no-arc length for zinc is decidedly less than that for copper.

Zinc blows fairly cleanly; the molten metal is not scattered far, but occasionally some globules show a tendency to continue to burn in air where they fall. It is a good material from a short-circuit point of view.

Tin in open-type cut-outs with short-circuit currents of ten times the normal fusing current blows softly and quietly, and the damage to terminals is slight. With 20 or 30-ampere fuses and short-circuit currents of 33 × N.F.C. there is, however, a great display of fireworks, accompanied by copious fumes, and with the lengths commonly used severe damage to terminals is likely to ensue.

With enclosed fuses the minimum no-arc length was found to be somewhat greater for zinc than for copper.

The minimum no-arc lengths for enclosed fuses of copper and zinc under various conditions and for fuses up to 50 amperes are given in fig. 2. In inductive circuits zinc gives lengths about 20 per cent. greater than those given in fig. 2, which are for non-inductive circuits. Tin gives length rather greater than zinc in each case.

The different metals behave in a characteristic manner on fusion with regard to the duration of the current rush on short-circuit, the tendency of the arc to persist, and the inductive pressure rise on breaking the circuit.

The oscillograms in fig. 3 show the behaviour of copper and tin open-type fuses on inductive circuits:—

*Copper*—Fig. 3A, 110-volt circuit.—The inductive pressure rise is usually only moderate, as the arc persists for a definite but short time.

Fig. 3B, 220-volt circuit.—The arc persists for a considerably longer period; the voltage rise is fairly small and irregular. The current rush does not rise to the value determined by the resistance of the circuit, owing to the quick action of the fuse.

*Tin*—Fig. 3D, 110-volt circuit.—The inductive pressure rise is usually higher than that of copper, and the duration of the arc is less. Occasionally a considerable voltage rise is obtained.

Fig. 3B, 220-volt circuit.

Inductive pressure rises of as much as four times the circuit pressure may be met with in moderately inductive circuits. In the experiments with the oscillograph a choking coil of very low resistance was inserted in series with the fuse; the value of the inductance was 0·023 henry with the normal fusing current (27 amperes) of the fuses under test flowing in the circuit. The value of the inductance would, of course, be less with short-circuit current flowing on account of the saturation of the core of the choking coil.

The minimum no-arc length was increased on circuits with an inductance of 0·023 henry as against circuits in which the inductance was only that due to the generator and leads; the results are

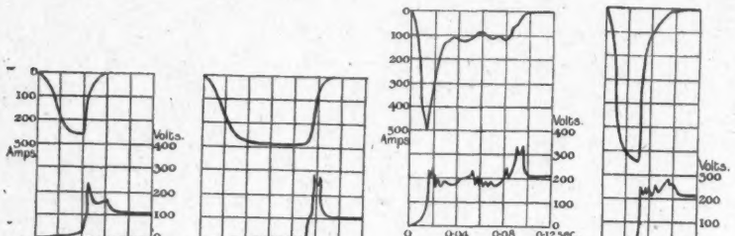



Fig. 3.—Oscillograms at Rupture of Circuit.

A and B, Copper; D and F, Tin.

shown in fig. 2. On non-inductive circuits the tests showed comparatively small voltage rises, and these were of short duration.

In order to test the magnetic blow-out effect obtainable from the circuit conductors, the leads to the fuse terminals were bent through a right angle, as shown in fig. 4.

It was found with this arrangement that the minimum no-arc length for open-type fuses could be very considerably reduced. For instance, with a 27-ampere copper fuse on a 220-volt circuit with leads bent up for a distance D = 4 in., the minimum no-arc length was 0·7 in., as against a length of 3·6 in. with the circuit cables entering the terminals in the ordinary way. Short-circuit current = 33 × N.F.C. The length was not materially increased with the bend in the leads reduced to D = 1 in., and even when an arc was formed it was of short duration, and little damage was done to the terminals. This magnetic blow-out arrangement might well be taken advantage of in practice, as has already unwittingly

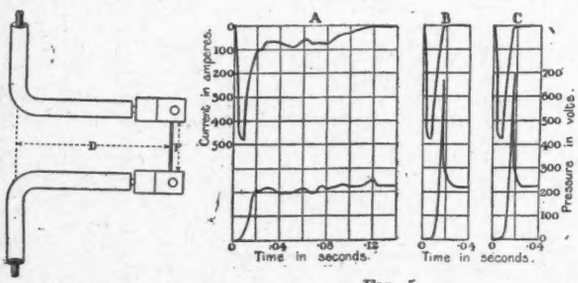



Fig. 4. Fig. 5.

Fig. 4.—Arrangement of Leads to Fuse for Magnetic Blow-out Effect.

D, Distance through which leads are bent up at right angles; F, Fuse length.

Fig. 5.—Oscillograms of Magnetic Blow-out Effect with Copper Fuses of Open Type on 220-Volt Circuit. Fuses placed in a separately-excited Field-coil Spool.

A, No magnetic field; B, Lateral magnetic field; C, Longitudinal magnetic field; N.F.C. = 20 amperes.

been done with some forms of knife-blade terminals, and terminals in which the cables enter from the back in contradistinction to the sides.

A number of oscillograms were obtained for open and enclosed-type fuses when blown in a magnetic field (*a*) at right angles to the length of the fuse, (*b*) parallel to the length of the fuse (fig. 5).

*(To be continued.)*

**Electro-Harmonic Concert.**—The last smoking concert of the season is to be held to-night at 8 p.m., at Cannon Street Hotel (Great Hall). The programme includes songs by Messrs. Noel Fleming and Dalton Baker; duets by Messrs. H. and G. Stubbs; violoncello solos by Mr. B. W. O'Donnell. The other arrangements are:—Mr. Henry Hull, conjuring and juggling; Mr. Wilson James, humorous songs; Mr. Ernest H. Mills, lightning sketches; Mr. Nelson Jackson, humorous sketch; and Mr. Walter Graham, the human marionette.

## NEW ELECTRICAL DEVICES. FITTINGS, AND PLANT.

### Reliance Jig.

The accompanying illustration (fig. 1) shows the Reliance twist-drill-grinding jig, which is being supplied by Mr. W. E. Crowther, of 308, Mansfield Road, Nottingham.

The jig is fixed by a single nut to any emery wheel, however large or small, and is instantly removable. Cheapness, adaptability,

Fig. 1.—Reliance Grinding Jig.

convenience, and freedom from complication are claimed by the maker as its attributes. It may be used on either face of an emery wheel, at the front or back, the bracket being swung over and locked at the desired angle, for adapting it to the smallest wheel, or fixed in a horizontal position for wet grinding.

It may be mounted on a base-board clamped down to a lathe bed; the wheel being carried by the chuck or mandrel nose. The bracket portion may be detached and fixed on a bolt carried by the emery wheel pedestal, parallel to the spindle, thus making a permanent attachment. Where neither emery grinder nor lathe is available, a wheel or stone may be mounted horizontally in an ordinary bench drill, and the bracket portion of the jig carried on a vertical bolt screwed into the bench, the wheel being raised or lowered by the feed for the various sizes of drills. The jig lends itself readily to many other modes of application. No adjustment is necessary for the various sizes of drills, which can be laid in their proper places in the trough by following the instructions given, and secured by means of the bridge clamp, which also provides for an exact half-turn when grinding the second edge.

Some notes on the use of this device will be found in an illustrated description issued by the maker.

### A.C. No-Volt Release Oil-Break Switches.

In connection with recent proceedings at the Home Office inquiry, the following particulars of the patent switches made by Messrs. Eckstein, Heap & Co., St. Simon Street, Salford, may be of interest.

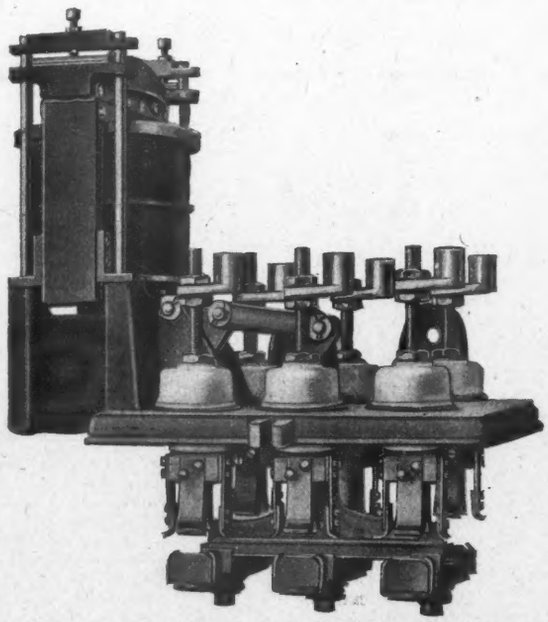


Fig. 2.—Automatic Switch, Open Type, for 50 Amperes.

The switchboard pattern for 50 amperes is shown in fig. 2, and a diagram of connections is given in fig. 3. The special features of the switch are: Automatic no-volt release; make and break under oil; automatic overload release, which cannot be held in on an overload. The switch is also of the remote control type, and is capable of being easily interlocked with the usual forms of starters. The whole of the working is effected by the alternating current, whether single or polyphase.

Referring to fig. 3, the main cables from the supply source are connected through the fuses $F_1$, $F_2$, $F_3$, to the terminals $A_1$, $A_2$, $A_3$ of the oil switch, and the outgoing cables to the motor are connected to either the terminals $B_1$, $B_2$, $B_3$, of the oil switch, when overload features are not supplied, or to the terminals 5, 6, 7, of the trip coils when these are fitted.

To close the main oil switch, the operating switch, which can only rotate in the clockwise direction, is turned to position 8—9. Current now flows from the line $A_1$, through the coil 10 of the electro-magnet 12, back to line terminal $A_2$. This causes the plunger 13 to be drawn up against the yoke 14.

The bottom of the plunger engages with the bell-crank lever 15, and pulls it up, thus forcing the movable contacts 16 into the fixed contacts, and thereby closing the main circuit; at the same time the toggle levers 18 and 19 are forced over their dead centre, thus holding the movable contacts mechanically in the closed position.

The operating switch is constructed so that it cannot be left in this position, but immediately passes into the position 20—21, in which the current passes from the line $A_1$ through both coils, 10, 11, of the electro-magnet, back to terminal $B_2$ of the main oil switch.

It will therefore be observed that the switch is closed by means of the top coils being energised from the incoming line side of the source of supply, whereas the electro-magnet plunger is held up by means of both coils in series energised from the source of supply, but connected on one phase to the incoming line side $A_1$, and on the other phase to the outgoing line side $B_2$ of the main oil switch.

In this position of the operating switch, which is marked "Starting," the trip coils are inoperative, so that if a heavy current passes, as will be the case while the motor is starting up, the switch will not be automatically released.

After the motor has run up to speed the operating switch is turned into the position 22—23, marked "Running," in which the current passes from the line through both coils 10 and 11 in series of the electro-magnet, and through the release arms 24, 25, of the overload trip coils.

If now an overload of a pre-determined amount occurs on any phase, one of the plungers 26, 27, 28, of the overload trip coils is drawn up and hits the striking bar 29, causing the contacts 30 to part, and thus opening the electric circuit of the operating coils 10 and 11. The plunger 13 immediately falls, and in doing so strikes the bell-crank lever 15, thus releasing the toggle levers 18, 19, and causing the movable contacts 16 to fall, thereby automatically opening the main circuit.

If the supply circuit fails the electro-magnet is de-energised, and the plunger 13 therefore falls as described above and automatically opens the main oil switch.

After the main oil switch has opened, either automatically due to a failure of the supply circuit or to an overload, or by the operating switch being turned to the "off" position, it cannot be closed until the supply circuit voltage has been restored, and the operating switch turned so as to repeat the series of connections described above.

In order to interlock the device with the starter, so that the latter must be put in the correct starting position before it is possible to close the main oil switch, a pair of contacts are added to the starting switch, which are connected in series with the operating coil. The connections are such that these two contacts must be bridged electrically before it is possible to get any current through the operating coil.

These contacts are fixed on the starting side of the starting switch. It is, therefore, necessary to close the latter in the starting position, thereby bridging these contacts. This feature is a very important one, as it practically makes the apparatus fool-proof. We are informed that all the three-phase motor panels which Messrs. Eckstein, Heap & Co. supply have the starter and the main switch interlocked in this way.

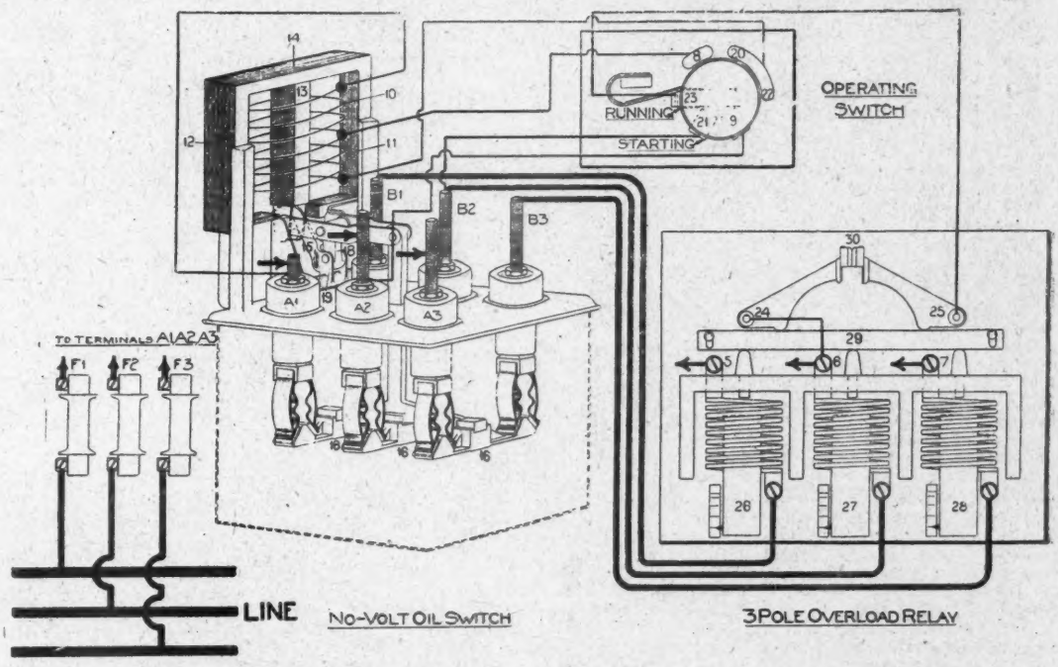



DIAGRAM OF CONNECTIONS FOR 3 POLE NO-VOLT OIL SWITCH WITH OPERATING SWITCH, AND 3 POLE OVERLOAD RELAY

Fig. 3.

## Motor-Car Specialities.

In the list relating to electric motor-car accessories which was recently issued by Messrs. Ward & Goldstone, of Salford, particular attention is directed to various motor-car accumulator-charging methods. The Hydranamo method, which consists of a small water motor and dynamo coupled on to the same spindle, is shown in the accompanying figure 4. This set, if connected to the cellar water-tap, gives an output of 2 amps. at 6 to 8 volts, which is sufficient for charging the standard motor-car ignition accumulator. As a matter of fact, we understand that it will give a higher output than this on a water-pressure over 50 ft. The firm manufactured and sold many hundreds of these sets during last season with gratifying results.

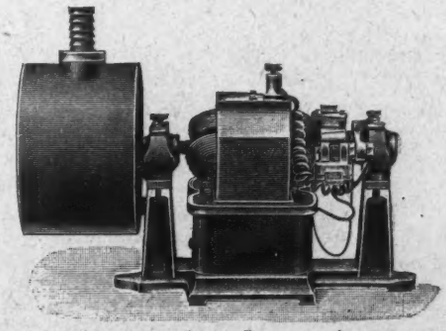


Fig. 4.—"Hydranamo" for Charging Accumulators.

Another means described in the list is the W. & G. Multum motor-generator method. It consists of a small motor and dynamo

running on the same spindle, which will work from any lampholder circuit, taking a small current at the lighting voltage at the motor side, and at the generator side giving a low voltage with a heavy current. These are for motor garages where electric lighting current is available.

We may also draw attention to the firm's Sherborne petrol engine and dynamo set. This consists of a small ½-H.P. petrol engine coupled to a dynamo with an output of about 150 watts, which is sufficient for a fair-sized garage. These sets are very compact, only taking up a space of about 2½ ft. by 1 ft., and, it is claimed, work well. In addition, this set, if used to charge accumulators, is also quite sufficient for lighting up an average sized house.

All of the lines mentioned are of English manufacture. The catalogue also shows pocket voltmeters, electric head, side, and tail lights for motor-cars—in fact, almost every electrical appliance used in the garage or on the car.

## Tantalum Lamp Fitting.

The "Attracta" Electrical Co., of 4 and 5, Warwick Court, Holborn, W.C., are supplying the "Effulgent Holophane" fitting for tantalum lamps, which we show in fig. 5. The fitting is a combination of the "Effulgent" aluminium reflector with a special

Fig. 5.—"Effulgent Holophane" Fitting.

"Holophane" globe screening the lamp. We are informed that the reflector is designed to remedy the lack of downward light from metallic filament lamps, and the compound holophane globe is secured to the reflector by a gallery. We understand that a larger type is supplied for long metallic filament lamps.

## A.C. No-Volt Release Switches.

A type of no-volt release for single-phase alternating-current motors, which has been made for a considerable time by Messrs. Langdon-Davies Motor Co., Ltd., Southwark Works, Deverell Street, S.E., is shown in fig. 6 herewith. This illustrates a starter

Fig. 6.—A.C. Starter with No-Volt and Overload Release.

fitted with both no-volt and overload release devices, the action of which will be readily understood from the figure. The starter is made in sizes suitable for both small and large motors, and the no-volt cut-out can also be had independently; similar cut-outs are also made for two and three-phase circuits.

## Electric Stoves.

Messrs. O. C. Hawkes, Ltd., of 69 & 70, Aldersgate Street, E.C., have issued a new leaflet in which they show some additions recently made to their patterns of electric stoves. They now make these stoves specially adapted for heating greenhouses and garages, and, of course, have various designs for every room in the ordinary

Fig. 7.

Fig. 8.

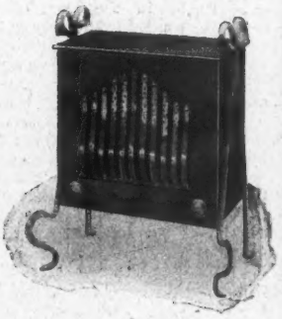


Fig. 9.

household. Among special lines may be mentioned a patent letter drying stove. Three small illustrations given herewith show respectively the "Yacht" type for ship's cabin service (fig. 7), the "Cupid" for morning rooms (fig. 8), and the "D'Orsay" for drawing rooms (fig. 9).

## Simplex Fuseboards.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have introduced a cheap line in fuseboards for the ordinary class of house work. This is shown in the accompanying illustration of the five-way pattern. The board can be provided with three different types of fuses: type A, being the ordinary grooved china fuse-bridge; type B, tubular fuse-carrier for 15-ampere circuits; and type C, for magazine replacement fuses. The latter allows non-technical persons easily to replace a fuse, and the bobbin on the 5-amp. size carries 50 replacements. These fuses are mounted on two battens, and when in position are divided by a

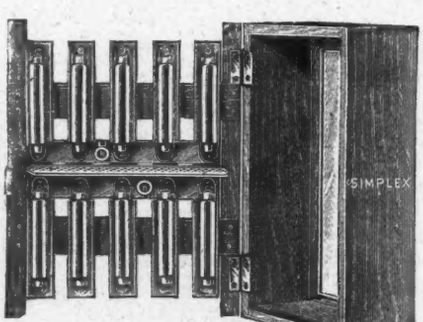



Fig. 10.—Simplex Five-Way Fuseboard.

fillet of asbestos. The case itself is strongly made of teak, with dovetailed joints throughout and a glass front. It is not provided with lock and key, but this can be arranged for at a slight extra charge. All the brass connections are of ample size to give the necessary capacity.

Another special line of the Simplex Co. is their time-element thermal cut-out, which is actuated entirely by the heat generated in the motor circuit or other apparatus it protects. It is claimed that it not only allows a momentary rush of current, but that it also opens the circuit as soon as the excess of current becomes dangerous, and only comes into action at such a moment. It is so constructed as to be proof against damage by unskilful handling. The device is very simple, and consists of a chamber containing a resistance, above which is placed a corrugated capsule, the expansion of which causes a piston pressing directly on to it to raise and actuate the trigger of the switch. The capsule can exert a pressure of 20 to 30 lb. without being damaged, the operation being therefore assured under any circumstances. The burning-out of a motor

or other apparatus is caused not only by an excessive current, but also by the time this excess is allowed. This device is based on that principle, and, once set, it acts quicker or slower according to the magnitude of the current flowing.

## PARLIAMENTARY.

### Wolverhampton Corporation Bill.

On Tuesday Mr. Corrie Grant's Select Committee of the House of Commons considered the Bill promoted by the Wolverhampton Corporation, which was of an omnibus character, but provided for an extension of time for the construction of a number of tramways.

Mr. Ram, K.C., who with Mr. Jeeves, appeared for the Corporation, said there was already an elaborate system of tramways at work, and a certain number of lines which were authorised but not yet constructed. The authorised lines were in Lea Road, Penn Road, Worcester Street, Lower Stafford Street, Stafford Street, Bilston Street, Salop Street, and Cannock Road.

The Town Clerk was called and proved a number of tables relating to the working of the tramway and electricity undertaking. The result of the working of the tramways for seven years up to March 31st last was as follows:—

| Year. | Gross profit. | Renewals. | Deficit after providing for interest and sinking fund. |
|---|---|---|---|
| 1901 ... | £1,144 ... | — ... | £114 |
| 1902 ... | £1,585 ... | — ... | £2,065 |
| 1903 ... | £7,981 ... | £1,750 ... | £2,322 |
| 1904 ... | £8,680 ... | £3,213 ... | £4,688 |
| 1905 ... | £15,168 ... | £4,790 ... | £4,495 |
| 1906 ... | £17,473 ... | £5,364 ... | £3,482 |
| 1907 ... | £19,061 ... | £5,301 ... | £1,291 |

With regard to the electricity supply undertaking the results were as follows:—1901, net loss £131; 1902, profit £508; 1903, profit £3,445; 1904, profit £2,775; 1905, profit £3,454; 1906, profit £3,216; 1907, profit £3,653. Of the profits £13,254 had been placed to the reserve and renewals fund, £2,831 to the relief of rates, and £966 had been disposed of under other heads.

Mr. S. Craddock, deputy chairman of the Tramway Committee, explained the reasons why the tramways had so far not been constructed, which was chiefly due to the necessity of street widenings. They had the Lorain surface-contact system in Wolverhampton, which he believed was the only place in the country where the system was at work.

The Committee allowed an extension of time for three years and also allowed Clause 6, which provided for the purchase of land for the tramway undertaking.

After consideration the Committee rejected a clause to give the Corporation power to deal with property left in tramways, the Chairman pointing out that although there might be difficulties in the way of storage of such property, still the Committee did not sit there to legislate.

### London and Windsor Motor Roads, Tramroads and Tramways Bill.

Lord Onslow presided on Thursday, March 19th, over the Standing Orders Committee of the House of Lords to consider the petition of the promoters of the above Bill that the standing orders be dispensed with. The Bill seeks to incorporate a company, with a capital of £1,215,000, to construct a motor roadway from Hammersmith to Windsor, and it was proposed to construct a tramway, to be worked electrically, on either side of the roadway.

When the Bill was before the Examiner, no fewer than 1,700 allegations of non-compliance with standing orders were made by Mr. Cripps, on behalf of the London United Tramways Co., and by Mr. Frere, on behalf of the London Motor Roadways Approach Bill. The principal allegation was with reference to the deposit of plans, which simply showed the line or route, and gave no particulars with regard to the construction of the tramways.

Mr. Kennedy, on behalf of the promoters, pointed out the difficulties which the promoters were under in regard to standing orders, owing to the fact that the scheme was partly tramway and partly tramroad, to which different standing orders were applicable.

Mr. Cripps and Mr. Frere having addressed the Committee, it was announced by the Chairman that it had been decided not to suspend the standing orders. The Bill accordingly cannot be proceeded with this session.

### Finchley Urban District Council Bill.

This Bill was several days before Mr. Corrie Grant's Select Committee of the House of Commons. A great deal of it consisted of building and sanitary matters, but power was also asked to grant discounts to electric light and power users, and to provide for the refusal by the Council to supply electricity in certain cases. Clause 13 sought to authorise the Council to supply electricity outside the district, and Clause 14 to supply electric energy for traction purposes. Mr. Ram, K.C., and Mr. Vesey Knox, K.C., appeared for the promoters, and a number of local gas companies opposed the Bill.

Mr. E. Calvert, electrical engineer, was called in support of the Bill, and said that the undertaking of the Finchley U.D.C. was started in 1903. The station was built on the freehold property of the Council, and they had sufficient spare plant to supply the roads named in the Bill without incurring any further capital expenditure. The capacity of the station was 650 kw., and the supply 525 kw., and they had a spare plant of 350 kw. They had 60 miles of mains laid in the district, and they had no intention of laying down any new mains in the immediate future. The number of consumers had shown a considerable growth. When they opened in October, 1903, they had 35 consumers; on April 1st, 1904, 143; April, 1905, 360; April, 1906, 678; April, 1907, 1,057; and on March 14th, 1908, they had 1,457 consumers. They had obtained about 400 new connections in the last 10 months. There had been a greater increase in the private supply. There had been two serious fires at the works, which had naturally affected the finances of the undertaking. Mr. Preece had been called in to advise the Council on the undertaking, and his report showed that roughly £40,000 had been spent on the generating station, and £50,000 upon the distributing system. They had been in negotiation with the North Metropolitan Electric Power Co., for a supply of electricity in bulk, and the Council would accept a bulk supply if they could get it as cheaply as they could generate it, but the negotiations with the company had not come to a head. They had received applications from persons outside the area for a supply, but they did not entertain them, as they did not wish to embark on any large electrical undertaking. All they asked was that they should be allowed to supply the people who were within a few yards of their mains in the Great North Road and in Woodhouse Lane, but who lived in the district of Friern Barnet.

After hearing further evidence the Committee approved of the electric clauses, with the exception of Clauses 13 and 14, which were withdrawn.

### London County Council (Tramways and Improvements) Bill.

Lord Sanderson's Committee of the House of Lords had this Bill under consideration on Wednesday and Thursday last week.

Mr. Erskine Pollock, K.C., for the L.C.C., said that the Bill was the usual omnibus Bill of the Council, and was promoted both for the construction of tramways and for the carrying out of certain street improvements. Within the last few days a greater part of the opposition to the Bill had been withdrawn, and it would not, therefore, be necessary to go into all the sections in detail. The total length of tramway line in London was 131 miles, and of this the Council now owned 120 miles. The remainder it was the intention of the Council to acquire, under their purchasing powers, by the year 1911. Ultimately the whole would be worked by electricity, but at present there were 52 miles worked by horse traction. In respect of line No. 7, a double line on the south side of the Thames connecting Southwark with Blackfriars Bridge, he might remark that its construction would carry out a suggestion of the Traffic Commission. The opposition on the part of the Southwark Borough Council to this part of the Bill was the only opposition left. In the construction of this line, which would cost some £19,700, it would be necessary to pass very near to a public convenience near Blackfriars Bridge, and as it would be expedient to remove this convenience, the Borough Council wished to have a compensation clause. The money paid in compensation would be devoted to the construction of a convenience and subway at the Elephant and Castle. Counsel's objection to this was that it was a proposal quite outside the notices given in reference to the Bill, and would involve the risk of the Bill being thrown out of Standing Orders.

Mr. Vesey Knox, K.C., who appeared with Mr. Courthope-Munroe for the Borough Council, explained that certain powers acquired by the Borough Council in 1904 with respect to the carrying out of such an improvement at the Elephant and Castle had lapsed, but the Council intended to ask for a revival of those powers. A sum of £6,000 paid by the Baker Street and Waterloo Railway Co. as compensation in respect of the works had been allocated for that purpose. A subway was very badly needed at the Elephant and Castle. Mr. Vesey Knox said that he would raise the question before the House of Commons Committee, and the Committee thereupon passed the preamble.

**West London, Barnes and Richmond Tramways Bill.**—It has been decided by the Standing Orders Committee of the House of Commons that standing orders may be dispensed with in the case of the above Bill, and that the parties be allowed to proceed on condition that all tramways are struck out of the Bill, in respect of which the consents of local and road authorities are not proved before the Committee to whom the Bill is referred.

**Croydon and Southern District Tramways Bill.**—On Thursday, March 19th, the Standing Orders Committee of the House of Lords considered the question of whether Standing Orders should be dispensed with in the case of the above Bill, as the promoters had failed to obtain the consent of the Croydon Rural District Council through whose district it was proposed to construct a portion of the tramways. The Committee decided that the Standing Orders could not be dispensed with.

**Stockport Corporation Bill.**—A Select Committee of the House of Commons, presided over by Sir H. Kimber, has found the preamble of the above Bill proved, which, amongst other things, authorises the construction of a tramroad in connection with the waterworks, the cost for which is estimated to be £8,600.

**London United Tramways Bill.**—The Standing Orders Committee of the House of Commons has decided to suspend standing orders in the case of this Bill, and to allow the parties to proceed. The promoters failed to get the necessary consents of the local authorities with regard to the construction of a tramway over King Edward VII Bridge at Kew.

**Fires on the District Railway.**—In the Parliamentary papers, Dr. Rutherford asks the President of the Board of Trade whether his attention has been called to one or two outbreaks of fire occurring recently upon the District Railway; and whether he will ask the directors to post up notices in the carriages, &c, telling the passengers what to do in case of fire. Mr. Lloyd-George, in reply, says that "fusing" can hardly be described as "outbreaks of fire." A notice of the kind suggested would, in the opinion of his advisers, be more likely to create alarm than to add to the security of passengers. We expressed the same opinion in a leaderette in the ELECTRICAL REVIEW for January 24th.

**Cost of the Pacific Cable.**—In the Parliamentary papers Mr. Harold Cox asks the secretary of the Treasury if he can give any further explanation than that contained in the estimates, of the fact that the estimated grant in aid to the Pacific Cable for the year 1908-9 shows a considerable increase over the estimated grant for 1907-8. Mr. Runciman, in reply, states that in estimating the amount of the grant in aid required for any year, account is taken of the probable balance in the hands of the board at the beginning of the year available for expenditure. Last year it was estimated that the balance available on April 1st, 1907, would be £20,355, and the grant in aid was reduced by that amount. The balance available on April 1st, 1908, is now estimated at £6,976, and this difference accounts for the increase in the grant in aid. The estimated excess of expenditure over traffic receipts is practically the same for the two years.

**Manchester Tramways.**—Tramway Orders Confirmation Bill (No. 1) was before the Examiner on Monday for proof of compliance with standing orders, and was ordered to go forward for second reading. The order authorises the Manchester Corporation to construct three small tramways within the borough to link up existing tramways.

**Telephone Fees.**—Mr. Bright, in the Parliamentary Papers, asks the Postmaster-General whether he can arrange, in the case of long-distance calls, that a second call or extension of the time of speaking can be allowed at less than double the original fee, as the very short time allowed deters people from trying long-distance calls.—Mr. Buxton replies that the greater part of the telephone trunk calls made during business hours occupy less than three minutes; and in view of the large and urgent demand for such communication, a charge which would increase the average length of conversation would not be to the general benefit.

## NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

5,231. "Improvements connected with arc lamps." VERITYS, LTD., and C. B. WALKER. March 9th.

5,262. "Improvements in sewing machines and electric apparatus or motor-propeller and the like." R. M. HOLLAND. March 9th.

5,264. "Internal combustion engine with magneto-igniter for actuating cycles and the like." C. A. ALLISON. (Société Anonyme H. & A. Dufaux & Cie., Switzerland.) March 9th. (Complete.)

5,271. "Improved automatic electric fire and heat alarm." J. W. BUTTERWORTH. (Date applied for under Sec. 91 of the Act, October 23rd, 1907, being date of application in New Zealand.) March 9th. Complete.)

5,279. "Improvements relating to insulating impregnating and protective materials or compositions." E. S. ALI-COHEN. March 9th. (Complete.)

5,297. "Improvements in primary batteries." W. A. F. BLEECK. March 9th. (Complete.)

5,306. "Improvements in alternating electric current motors." H. ARON. March 9th. (Complete.)

5,311. "Improvements in apparatus for producing electrical oscillations." W. P. THOMPSON. (Gesellschaft für drahtlose Telegraphie m.b.H., Germany.) March 9th. (Complete.)

5,317. "Improvements for electrolytically etching or depositing metals upon metallic surfaces and the like." S. O. COWPER-COLES. March 9th.

5,318. "Improvements in and relating to incandescent lamp sockets" F. A. SWAN. (Date applied for under Sec. 91 of the Act, March 15th, 1907, being date of application in United States.) March 9th. (Complete.)

5,331. "Improvements in and relating to reverse current or reverse power devices." M. B. FIELD and FERRANTI, LTD. March 9th.

5,372. "Improvements in reflectors for lamps, electric and the like." J. BEIN. March 10th.

5,374. "Improved portable choking or resistance coil for surgical or medical lamps." F. N. DAVIDSON. March 10th. (Complete.)

5,380. "Improvements in insulators." L. B. STEVENS, jun. March 10th.

5,387. "Improvements in the manufacture of electric incandescent lamps." A. G. BLOXAM. (Siemens & Halske Akt.-Ges., Germany.) March 10th. (Complete.)

5,415. "Improvements in incandescing or heating bodies containing or consisting of zirconium for incandescent electric lamps, heaters and the like." THE BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 10th.

5,416. "Improvements in filaments for incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 10th.

5,422. "Improvements in and relating to the holders for the shades or globes of gas and electric fittings." F. G. W. COLEMAN. March 10th.

5,435. "Improvements relating to telephony." J. L. CLOUDSLEY. March 10th.

5,440. "Improvements in portable motor-generators and their application for charging cells and other purposes." J. R. CRAIG, jun. March 11th.

5,444. "Electro-automatic sounding apparatus." C. F. VARELA. March 11th. (Complete.)

5,466. "New or improved safety trolley head for electric traction cars." S. WESTWOOD. March 11th.

5,489. "Improvements in and relating to the electrical control of railway traffic." W. R. SYKES, W. R. SYKES, jun., and C. J. COOKE. March 11th. (Complete.)

5,497. "Improvements in or relating to radio-telegraphy." G. REUTHE and THE AMALGAMATED RADIO-TELEGRAPH CO., LTD. (Date applied for under Sec. 91 of the Act, June 18th, 1907, being date of application in Germany.) March 11th. (Complete.)

5,510. "Improvements in braking systems using electric motors as generators." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 11th.

5,529. "Improvement in mechanism for operating the controllers used on electrically-driven cranes." W. FOX. March 12th.

5,549. "Improvements in apparatus for controlling electric circuits." W. R. COOPER. March 12th.

5,560. "Improvements in incandescent electric lamps." C. H. STEARN and C. F. TOPHAM. March 12th.

5,569. "Improved means for securing metal contact blocks or terminals to the bases of wall plugs, ceiling roses, and the like." THE HUNSLET ELECTRICAL POTTERY CO., LTD., and A. A. LINES. March 12th.

5,590. "Improved apparatus for registering telephonic calls." W. M. HERD and A. ESPLEN. March 12th.

5,610. "Improvements in and relating to incandescent electric lamps." ALLGEMEINE ELEKTRICITATS GESELLSCHAFT. (Date applied for under Sec. 91 of the Act, March 14th, 1907, being date of application in Germany.) March 13th. (Complete.)

5,611. "Improvements in electric motor controllers." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 12th.

5,628. "Improvements in and relating to the control and transmission of electric energy." R. P. MYERS and E. A. GEDGE. March 13th.

5,634. "Improvements in and relating to devices for mechanically and electrically actuating counters." W. HAMPSON and CHECKOGRAM (1908) LTD. March 13th.

5,640. "Improvements in or connected with electric motor-driven apparatus." MAVOR & COULSON, LTD., and S. M. MAVOR. March 13th.

5,655. "Improvements in electricity meters." E. J. PIPER. March 13th.

5,679. "Improvements in and relating to alternating electric current compensators or transforming devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 13th. (Complete.)

5,681. "Improvements in and connected with electric light fittings." F. M. LONG. March 13th.

5,691. "Improvements in dynamo-electric machines for the production of continuous and alternating currents." J. SCHUERCH and G. HIMMEL. March 13th. (Complete.)

5,708. "Improvements in means for adjustably carrying shades for electric and gas lamps." E. A. SHOWELL and E. H. HARRIS. March 14th.

5,719. "Improvements in swing-out electric lamp carriers." T. L. SCOTT. March 14th.

5,748. "Improvements in electric lamp connections." H. C. GOVER, C. W. ZOEPHEL and G. B. J. BARHAM. March 14th.

5,781. "Improvements in or relating to aerial and other electrical conductors." G. W. PARTRIDGE and P. DAWSON. March 14th.

5,783. "Improvements in and relating to incandescent electric lamps." J. W. HOWELL. (Date applied for under Sec. 91 of the Act, March 16th, 1907, being date of application in United States.) March 14th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool; price, post free, 9d. (in stamps).

### 1906.

ELECTRIC ARC LAMPS. H. Beck and Deutsche Beck-Bogenlampen Ges. 28,602. December 14th.

ELECTRIC ARC LAMPS WITH SUPPORTED ELECTRODES. H. Beck and Deutsche Beck-Bogenlampen Ges. 28,601. December 14th.

NEW APPLICATION OF INDUCTION FURNACES. G. Gin. 28,638. December 15th.

### 1907.

ELECTRIC HEATING PADS. L. W. Shellhamer. 3,543. (Date applied for under International Convention, April 2nd, 1906.) February 12th.

APPARATUS FOR CONTROLLING THE SUPPLY OF ELECTRICAL ENERGY FROM ALTERNATING CURRENT ELECTRIC GENERATORS OR MAINS TO ALTERNATING CURRENT ELECTRIC MOTORS. A. P. Wood, R. S. McLeod and Lancashire Dynamo Co. 3,740. February 15th.

ELECTRIC FURNACES. A. Reynolds. 3,914. February 16th.

VESSELS FOR CONTAINING FUSED SALTS DURING ELECTROLYSIS. S. O. Cowper. Coles. 3,982. February 18th.

SAFETY PLUGS FOR ELECTRIC CONDUCTOR SYSTEMS. C. Meyer. 4,055. February 18th.

WIRELESS ELECTRIC SIGNALLING. S. Cabot. 4,125. February 19th. (Date applied for under International Convention, March 10th, 1906.)

WIRELESS ELECTRIC SIGNALLING SYSTEMS. S. Cabot. 4,128. February 19th. (Date applied for under International Convention, March 10th, 1906.)

SYSTEMS OF ELECTRICAL DISTRIBUTION. J. S. Peck. 4,132. February 19th.

WIRELESS ELECTRIC SIGNALLING SYSTEMS. S. Cabot. 4,134. February 19th. (Date applied for under International Convention, March 10th, 1906.)

REGULATION OF ELECTRIC MOTOR-GENERATOR SETS. British Thomson-Houston Co. and E. Garton. 4,833. February 27th.

ALTERNATING CURRENT COMMUTATOR MOTOR. W. S. Franklin and S. S. Seyfert. 5,836. March 11th.

JOINTING, BONDING, TESTING, AND DISTRIBUTING BOXES AND SLEEVES FOR LEAD OR OTHER METALLIC COVERED WIRE AND CABLE FOR ELECTRICAL PURPOSES. H. H. Hill. 5,952. March 12th.

MAGNETIC WEDGES FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co., United States.) 7,048. March 23rd.

MARINERS' COMPASSES. R. Smith. 7,167. March 23rd.

MARINE ELECTRIC STEERING GEAR. B. P. Haigh. 7,410. March 28th.

ELECTRIC CONTACT MAKERS. F. W. Cooper. 7,432. March 28th.